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NOTES FOR THE MONTH.

THE Prime Minister made the following statement in the House of Commons on 11th December :—

**Agricultural
Economic Inquiry.** “The Government propose to set up a Tribunal of Investigation, consisting of three well-known economists, with the following reference :—

‘To inquire into the methods which have been adopted in other countries during the last 50 years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labour at a living wage, and to advise as to the methods by which those results could be achieved in this country.’ ”

At the time of going to press, the names of the economists to be appointed had not been announced.

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THE Minister of Agriculture has now set up the Committee which is to inquire into the methods and costs of selling and distributing agricultural, horticultural, and dairy produce in Great Britain, and to consider whether, and if so by what means, the disparity between the price received by the producer and that paid by the consumer can be diminished. The

Departmental Committee on the Distribution and Prices of Agricultural Produce. The constitution of the Committee is as follows :—The Marquess of Linlithgow (Chairman), Sir Basil Mayhew, K.B.E., Mr. A. W. Ashby, Mr. Ernest R. Debenham, Dr. Charles M. Douglas, C.B., Mr. Percy A. Hurd, M.P., Mr. Rowland B. Robbins, C.B.E., Mr. R. J. Thompson, O.B.E., Mrs. Margaret

Wintringham,' M.P. The Secretary of the Committee is Mr. A. W. Street, and the Assistant Secretary, Mr. F. Grant, both of the Ministry of Agriculture and Fisheries.

The first meeting of the Committee was held on 15th December, to consider the procedure. The Committee decided to hold meetings in private, and to take evidence from representative associations immediately after Christmas.

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A SMALL expert Sub-Committee was appointed by an agricultural Committee of the late Cabinet in October last to consider

the question of agricultural credit. The

Committee on Sub-Committee has held fifteen meetings,
Agricultural Credit. which, so far, have been devoted almost exclusively to the hearing of witnesses. It is understood, however, that it has now concluded the taking of evidence and is proceeding to the consideration of its report, which should be in the hands of the Minister early in the New Year.

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A BILL to give effect to the agreement come to between the Cabinet and the Canadian Government with regard to the future

conditions of importation of cattle from

Importation of Canada and other parts of the British
Animals Act. Empire, was passed by both Houses of Parliament during the past month and received the Royal Assent on 15th December, 1922. The agreement with the Canadian Government* is confirmed in the Act, which provides that Canadian store cattle brought direct from a Canadian port may be imported into Great Britain on condition that for 3 days before shipment and during the voyage the animals are kept separate from other animals and examined from time to time by an authorised veterinary officer of the Dominion, and found to be free from cattle plague, pleuro-pneumonia or foot-and-mouth disease. The cattle must be marked before shipment and must also at the time of shipment be free from mange or any other disease specified by the Ministry. The cattle are required to be landed at approved landing places where each cargo has to be detained and isolated for such period as is required for examination by veterinary inspectors of the Ministry. No cattle may be removed from the landing place except with a licence of the Ministry's Inspector, and then only to premises on which they are required to be detained for 6 days

* See this *Journal*, Dec., 1922, p. 770.

except that the cattle may pass to such premises through one market.

The Act also empowers the Ministry by Order to authorise the importation of Canadian animals other than store cattle without being subject to slaughter at the ports, but subject to certain conditions for the purpose of preventing the introduction of disease. The Act further makes statutory the existing requirement of 6 days' detention in the case of cattle landed from Ireland.

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A QUESTION on which the farming community is frequently asking advice is whether certain land is suitable for fruit-growing. To obtain fuller information than is at present available on this matter, an investigation is being begun by the horticultural stations at Cambridge University and at Long Ashton, Bristol University. Its precise object is to ascertain the extent to which fruit-growing can be correlated with soil type in two very distinct districts, viz., East Anglia and West Midlands. In the first district—East Anglia—fruit is grown on a variety of soils, while in the second district—the West Midlands—it is grown apparently on a single definite soil type. Factors, other than soil type, however, such as climate, altitude, aspect, and water table, which may influence suitability for fruit culture, seem to be relatively uniform in the first area, and to differ widely in the second.

Before the main work of the investigation could be commenced, it was necessary to determine the depth to which the soil sampling should be carried out. A preliminary investigation was made by the Long Ashton Station as to the extent and depth of the root range of fruit trees, and it seems that, for the types of soil in question the important zone of root range lies within two feet of the surface. This preliminary root investigation will be repeated by the Cambridge Horticultural Research Station.

The main survey will include at each plantation visited an examination of soil character, and behaviour of fruit trees; as far as possible, the features presented by all varieties of fruit will be recorded. An assistant soil analyst will be employed at each station for the analytical work. Plant pathologists already at the two Universities will co-operate in the investigation for the purpose of collecting information on diseases and pests of fruit trees under various conditions.

A special committee consisting of representatives of the two stations will co-ordinate the work. The small amount of money required is being provided by a grant from the Development Fund.

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IN a recent issue of this *Journal* (October, 1922) an article by Mr. J. Stoddart gave an account of the investigations that had been conducted by the Ministry into the question of the standardisation of packages for soft fruit. At a public meeting convened by the Ministry in July last these investigations were brought to the notice of those interested, and it was agreed that basket manufacturers should submit to the Ministry of Agriculture samples of their chip baskets, and that if the capacities be approved by the Ministry, the makers shall be entitled to stamp all similar baskets "No. 3 (or 4) Approved Standard Capacity."

So far eight firms have submitted samples of chip baskets, the capacities of which have been approved:—

The British Basket Co., Ltd., Leverington Road, Wisbech; Messrs. Dewsbery Bros., Wisbech; Messrs. J. Deaton & Son, Old Ford, London, E.; The Hulme Patent Advertising Match Co., Irlam, near Manchester; The Manchester Basket Co., Manchester; Geo. Marchant, The Lodge, Botley Road, Woolston, Southampton; The Tamar Valley and District Chip Basket and Box Making Factory, Ltd., Calstock.

These firms have been informed that similar baskets to these specimens may be stamped "Capacity approved by the Ministry of Agriculture and Fisheries." It is known that some of the above firms are already sending out baskets bearing these or similar words.

The advantages which would accrue to the horticultural industry as a whole by the use of packages of standard capacities have been dealt with so fully that it seems hardly necessary to discuss them. It may perhaps be worth while, however, to repeat that to the grower the use of standard packages would bring considerable gain. With packages of varying sizes his only means of ascertaining that the correct quantity of produce has been packed, is to weigh up each package separately—undoubtedly the proper method, though not yet generally followed. Unweighed packages will generally contain more than the reputed weight or less. Numerous complaints will be made in respect of the "shorts" and deductions made from the sales returns, whilst the over-weight will bring no advantage.

The grower who uses packages of varying capacities without weighing is, therefore, likely to lose financially and to bring discredit on himself for faulty business methods. In fact, present methods are being severely criticised by the retailers who experience serious losses from short weights, and they are pressing for the introduction of legislation to secure that the sale of all fruit and vegetables shall be by net weight or count. However successful such legislation may be in other countries, coercive methods in Great Britain are usually undesirable and are resorted to only when voluntary methods have failed. It is difficult, however, to see what defence can be put up to the demand for such legislation unless there is improvement in existing methods, and it may be wiser, therefore, to give the Voluntary Standardisation System of packages a chance. With the active support of the whole industry it would appear possible to obtain in the near future the general adoption of standard packages. Wherever possible, growers would be wise in their own interests to pack their produce in packages bearing marks showing they are of approved standard capacity. The British Standard Apple Box has already established itself in favour, and Standard Chip Baskets from several makers are now available for soft fruit. Some progress is being made, therefore, and it can be tested whether or no retailers will give them a preference. If the industry shows its desire to make this system successful the principle can be extended to other market packages.

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The importance of the potato crop renders it desirable that every grower should have an opportunity of comparing the crops of the newer varieties, which are immune from Wart Disease, with those of established kinds grown in his district, and of seeing in practice the most up-to-date systems of cultivating and manuring the crop. The Ministry proposes therefore to continue in 1923 potato trials on similar lines to those carried out during the past four years.

**Potato
Demonstration
Plots, 1923.**

The trials will, as before, be carried out by the Local Authorities for agricultural education. The main objects will be the demonstration of:—(a) the cropping powers of the newer varieties; (b) the advantages of an adequate system of manuring; and (c) the value of using "seed" from healthy stocks.

The Ministry has decided to include three of the most popular varieties susceptible to Wart Disease, in order to pro-

vide growers, with a comparison of the cropping qualities of the immune and the susceptible varieties. These will not be planted on land which is known to be infected with Wart Disease.

Varieties.—The varieties chosen for the Trials are:—

Immunes.—1st *Earlies* - Immune Ashleaf and Dargill Early.

2nd *Earlies* - Ally, Great Scot and Arran Comrade.

Maincrop - Tinwald Perfection, Kerr's Pink, Majestic, Bishop, Irish Chieftain, Rhoderick Dhu and Crusader.

Susceptibles.—Up-to-Date, Arran Chief and King Edward.

Supply of Seed.—The seed for the 1923 trials has been grown on a farm in Easter Ross. The crops were examined whilst growing and all plants affected with Black Leg, Mosaic, or Leaf Curl, and those not true to the variety were rogued out by the Ministry's inspectors.

It has been suggested to the Local Authorities that in cases where seed has been saved from the trials carried out in 1922, some should be planted in 1923 so that a comparison can be made between the cropping qualities of this seed "once grown" in England and seed direct from Scotland. If similar tests were made in 1922, the trials may be further extended to include seed "twice grown" in England.

Reports on the previous trials have appeared in this *Journal*, July, 1921, p. 350; May, 1922, p. 163.

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THE Anglesey Committee has reached an agreement to operate for six months up to 13th May next. It provides for the payment of a rate of 28s. for a week

**Conciliation
Committees in
Agriculture.**

of 58 hours (including Sundays) to male workers of 21 years of age and over, and proportionate rates for male workers between 18 and 21 years. It has been agreed that the provision of board and lodging shall be reckoned at 14s. per week and board only at 10s. per week. The Saturday half-holiday is to be observed.

Average Wages.—In reply to a question by Mr. Hope Simpson on 5th December, the Minister stated that from such information as was at the disposal of his Department it was estimated that the average minimum cash wage of ordinary agricultural labourers in England and Wales in November, 1922, was 28s., as compared with a wage of 18s. (including allow-

ances) in 1914, an increase of 55 per cent. The cost of living figures estimated by the Ministry of Labour showed an increase on 1st November of 80 per cent. above the 1914 level.

Unemployment Insurance.—The Minister informed Captain Bowyer on 5th December, in reply to a question as to whether the extending of benefits of the Unemployment Insurance Act to agricultural workers had been considered, that the question of the application of the Act to agriculture was considered as recently as last year by a Committee appointed by the Agricultural Wages Board, and representatives of the farmers' and farm workers' organisations. That Committee reported that there was general opposition both by employers and workers to the inclusion of agriculture in the general provisions of the Act. The Minister added that, so far as he was aware, the general feeling in the industry remains as then reported.

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A FURTHER rise was recorded for November in the average prices of agricultural produce in England and Wales, the increase compared with the corresponding

The Agricultural Index Number. month in the years 1911-13 being 62 per cent. in November against 59 in October.

There has thus been a rise of 5 points in two months, but the November figure remains decidedly lower than any recorded during the first eight months of the year. The proportionate increases in price since the beginning of 1920 are shown in the following table:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING
MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.
January	200	183	75
February	195	167	79
March	189	150	77
April	202	149	70
May	180	119	71
June	175	112	68
July	186	112	72
August	193	131	67
September	202	116	57
October	194	86	59
November	193	79	62
December	184	76	—

The increase in prices in November was fairly well distributed among the various descriptions of produce, fat cattle and

sheep, poultry and eggs being the only products sold off farms, which were relatively cheaper in November than in October, and in these cases the reductions were small. Cereals continued the rise recorded by the figures for the previous month, wheat being 32 per cent., barley 34 per cent. and oats 38 per cent. dearer than the average for November, 1911-13; in November of last year the corresponding figures were 41 per cent. for wheat, 61 per cent. for barley and 35 per cent. for oats. Potatoes, fruit and vegetables have all advanced, while hay remains unaltered, the slight fall in the price of hay in November corresponding with the fall which occurred from October to November in 1911-13.

Fat cattle were slightly cheaper in November than in the previous month, and the index number for fat sheep is also lower, in spite of a small increase in prices, the fall in the index number being due to the fact that there is normally a greater proportionate seasonal rise between October and November. Pigs are decidedly dearer. Store cattle and sheep fell slightly, but dairy cows show a further rise. Store pigs also advanced, by a further 13 points, and during November were nearly $2\frac{1}{2}$ times as dear as in November before the war. The advance is the more remarkable as a fall is customary at this time of the year, and it is evident that the high prices at present realised for fat swine, and the large quantities of surplus potatoes in the country, are creating an unusual demand for store pigs.

Milk and butter have remained practically unchanged, but cheese has advanced sharply in value, and in spite of a normal rise in price at this season of the year, the index number has jumped 19 points. Eggs although considerably dearer in November, show a slight fall compared with the corresponding month in 1911-13, as the normal seasonal rise in value is greater than that registered this year.

The average increase in agricultural wages during November, as compared with a pre-war wage of 18s. per week, was 55 per cent. as against an increase of 60 per cent. in October. These figures are calculated on the basis explained in the article in the December issue of the *Journal*.

The following table shows the average increase during recent months in the value of the principal commodities sold by farmers, together with corresponding figures for November, 1921 :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN
THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922.					1921.
	July.	Aug.	Sept.	Oct.	Nov.	Nov.
Wheat ...	53	53	23	24	32	41
Barley ...	49	48	26	29	34	61
Oats ...	55	59	31	33	38	35
Fat cattle ...	70	70	58	49	48	75
Fat sheep ...	107	103	90	90	87	53
Fat pigs ...	91	92	84	85	94	70
Dairy cows ...	64	67	63	69	74	102
Store cattle ...	39	42	33	30	29	46
Store sheep ...	108	114	109	106	93	50
Store pigs ...	115	128	125	135	148	82
Eggs...	80	64	96	104	98	144
Poultry ...	103	85	85	77	75	80
Milk ...	53	70	70	90	90	117
Butter ...	79	77	76	71	72	69
Cheese ...	50	51	41	36	55	25
Potatoes ...	75	14	1	3	8	135
Hay ...	37	54	52	45	45	45
	*	*	*	*	*	*

THE Ministry has recently been informed by the Department of Overseas Trade that the exportation of live stock for breeding

Export of Pedigree Stock. purposes may properly be included within the scope of the Export Credit Scheme. Agriculturists desirous of obtaining credits

in this connection should, therefore, make application to the Export Credits Department of the Department of Overseas Trade, 73, Basinghall Street, London, E.C. Full information as to the methods and scope of the Scheme, together with forms on which application should be made, will be supplied by that Department on application.

It will be understood that the Export Credits Scheme has been provided by the Government in order to facilitate the resumption of the ordinary means whereby traders and others can obtain facilities from their bankers to enable them to finance their export trade. Under it the Government are prepared, under certain conditions, to entertain proposals to guarantee drafts drawn against shipments of goods exported from the United Kingdom. All applications are required to be submitted through the exporter's bankers. Guarantees may be given under two systems: (a) for general credits, that is to say, credits which do not involve a separate reference to the

Department, in respect of each specific transaction, and (b) credits in respect of specific transactions.

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THE Ministry receives a considerable number of inquiries dealing with the more technical side of agriculture. In many cases these are, in accordance with the arrangements described in Leaflet No. 279 (*Technical Advice for Farmers*), passed on to the County Agricultural Organisers. These officers are naturally in a better position to advise on matters requiring a knowledge of local conditions than the Ministry's advisers at Headquarters. Some inquiries are, however, dealt with by the Ministry direct and it is proposed to publish from time to time a selection of replies given in the hope that these may be of interest to a wider circle than the correspondent to whom they were originally addressed. A first instalment of these replies will be found on page 956 of the present issue.

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WITH the object of assisting farmers and other buyers and sellers of corn and seeds to accustom themselves to selling by reference to the cwt., in accordance with the Corn Sales Act, 1921,* which comes into force on 1st January, 1923, the Ministry has prepared a series of tables of equivalent prices. These tables give for a price per cwt. of 5s. and each additional 2d. up to 18s., the equivalent price for the chief customary weights by which the different kinds of corn and other produce have been sold in the past. This set of tables has been published as "The Corn Sales Ready Reckoner" and is obtainable through any bookseller, price 5d., or from H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 6d. post free.

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* See this *Journal*, December, 1922, p. 778.

PATRINGTON FARM SETTLEMENT.

CAPTAIN J. K. HILL,

Director of the Settlement.

The Estate and its Administration.—The Patrington Estate was the first to be acquired by the Ministry of Agriculture and Fisheries under the Small Holding Colonies Acts, 1916 and 1918, with the object of establishing farm settlements for ex-Service men. The property, which is held on a 99 years' lease from the Office of Woods, is situated on the Humber Estuary about 15 miles east of Hull, in the area known as Sunk Island. On an 18th century map this island is shown to be only some 8 acres in extent, but it now comprises some 10,000 acres, representing the results of natural alluvial deposit and of land reclamation work during the past two centuries. The land taken over by the Ministry in 1917 extends to 2,363 acres, and a further 508 acres were acquired in 1919, but this latter portion has since been let off as one farm, and is not now included in the settlement area.

The Patrington Settlement is carried on under a scheme devised by the Ministry to meet the needs of ex-Service men, skilled or partially skilled in agricultural work, but without capital or possessed of insufficient means to enable them to take up the cultivation of a small holding. Briefly described, this scheme provides for the management of the settlement by the Ministry, but the profits, after all working expenses have been paid and an allocation made to a reserve fund, are divided between capital, management and labour in proportion to the amounts charged in respect of these items in the working account. A substantial profit was made in the first two years after the settlement was started, but since then, owing to the bad seasons and the agricultural depression, farming operations have resulted in a loss. The employees are paid wages at the rates prevailing in the district, and with very few exceptions ex-Service men furnish the whole of the labour employed. Another factor bearing on the adoption of the scheme was the unsuitability of the soil for farming in small areas, thus precluding the formation of small holdings grouped round a central farm as recommended by the Verney Committee.

For farm work in the neighbourhood it is customary to rely mainly on boys, who board and lodge with the foreman, and who are supplemented by casual workers when any additional

labour is required. This arrangement has a considerable advantage in keeping down the wages bill, but is impossible of adoption when the main purpose is to resettle married ex-Service men on the land. From a purely economic standpoint, therefore, the expenditure on labour on the settlement must necessarily be higher than on farms where the older local practice obtains. On the other hand, the number of persons formerly living on the area now farmed by the Ministry was probably never more than 65, whereas, on the settlement to-day, there are 55 married couples with 130 children, a total population of 240. The value of this contribution towards the larger social problems of rural resettlement and relieving the congestion of the towns must, obviously, be taken into account.

To house this large increase of population the Ministry added 40 new cottages to the existing accommodation. These are built in pairs and are of brick with tile roofs, each containing parlour, living-room, scullery and three bedrooms. A double pig sty with run and half an acre of garden ground have also been provided with each cottage. Thirty-six of the cottages were erected by August, 1919, and the building work since carried out up to the completion of the equipment in January, 1922, consisted chiefly of the repair and adaptation of existing buildings, the erection of the piggeries, and the provision of baths.

The addition of baths to the new cottages throws an interesting side-light on the stamp of man who has been settled at Patrington, for baths were not originally contemplated in the early building scheme, and their subsequent provision was a concession by the Ministry to a unanimous and insistent demand by the settlers.

Social Amenities.—The settlement has shaken down into a self-respecting community; and the present employees are of a good class of men and proud to constitute a virile branch of the British Legion from which they derive an excellent tone and social spirit.

This *esprit de corps* is particularly desirable as the settlement has to be self-dependent for its recreation. Entertainments of various kinds are given during the winter months in a special Recreation Hut which has been erected. This is also used for religious services, and for a Sunday School, conducted by residents, which has a good attendance of children. Special outdoor festivities are the Annual Sports both for children and adults, and patriotic celebrations on anniversaries such as Empire Day and Armistice Day.

Farming Operations.—This brief outline of the conditions under which the settlers live and work brings us to the actual cultivation of the land. The area comprises five farms, of which 1,777 acres are arable and 531 permanent pasture. The soil consists of a mud warp, varying in depth from six inches on the inner lands to four inches or less near the Humber bank, where nothing will grow which comes in contact with the silt subsoil. The methods of cultivation and cropping generally obtaining in the district are largely followed on the settlement, but certain departures from local practice have been instituted for the purpose of studying their efficacy under local conditions.

Sub-soiling constitutes one of these departures, and is worthy of a full trial. To avoid bringing up the unfertile silt, ploughing is kept to a very limited depth, with the result that a hard pan has been formed which is never broken up. The deeper cultivation and rough form of sub-soiling which the steam tackle affords have given very satisfactory cropping results; and sufficient work has been carried out on these lines to show that the land would readily respond to the principle of sub-soiling when carried out with modern implements that effectively break up the pan without risk of bringing up the silt.

Bare Fallow, and Fodder Crops.—With the farming conditions applicable to the soil and the district, where successive corn crops are grown, it is necessary, in the ordinary course, to introduce a bare fallow so that, whether foul or not, the soil may recover its fertility. This course is necessarily expensive, and its restriction on the possible output of the farm can be ill afforded in the present hard times. On the other hand, a leguminous crop, such as tares, may be relied upon to restore fertility to the land and reclaim the lost physical condition of the soil. It has been demonstrated during the past two years that Sunk Island land is ideally constituted for forage cropping and the production of silage, while for many reasons it is unsuitable for roots, which, consequently, are grown only in small quantities. It is hoped, therefore, that a sufficient substitute for the latter will be furnished by leguminous forage crops converted into silage. These should have the dual advantage of providing a valuable food substitute for roots, much needed in this class of farming, and also obviating the necessity for so many bare fallows.

Stock Keeping.—With a large bulk of straw to be consumed or trodden into manure, a heavy head of stock has to be main-

tained through the winter. In the absence of roots, the customary method in the district is to feed straw only as a bulk food, supplemented by cake and meals to the cattle in the yards, necessitating a heavy ration of concentrates to maintain them in good store condition. If beef had remained at war values or cake were half its present price, the system might be economically sound, but in the present circumstances it is difficult to see how it can be carried on profitably as a means of supplying manure for the land. The production of silage in sufficient quantity would, however, go far to meet the need for economical feeding, as store cattle fed with it would require far less of the concentrated foods.

Artificial Manure from Straw.—The method recently discovered of converting straw into valuable manure through the action of nitrogenous bacteria, may be of the greatest value in a corn-growing district where farmyard manure is a necessity and where a superabundance of straw has to be utilised. Such a drastic innovation, however, would be too serious an adventure for the ordinary farmer to embark upon without a convincing demonstration of its efficacy, but the possibilities are attractive and the system might prove of the greatest benefit in corn-growing districts generally. More particularly would it help those farmers who, for temporary financial reasons, are unable to ensure the productivity of their land by keeping a sufficient head of stock.

High Wheat Yields.—Holderness, and more especially the Sunk Island area, is an important wheat growing district, and very heavy yields are recorded. In 1921, 585 acres of wheat were harvested on the settlement, the highest yield per acre being just under 9 quarters of White Victor, and a satisfactory average of 6 quarters was obtained from the autumn-sown wheat. In the 1922 season, which was six weeks later than the previous year, there were 638 acres of wheat for harvest, but as yet no thrashing has taken place. It is feared that the want of sufficient sun has been responsible for a disappointing yield; there is a heavy bulk of straw and the crops were very badly laid by wind and rain. So far there has been no experimental work to determine the comparative yields of different varieties of wheat, which it is essential should be carried out under identical conditions in the same field. As some of the fields exceed 50 acres in extent it should be possible to obtain a convincing demonstration in the future on such an acreage.

That Victor wheat gave the highest individual yield last year cannot be regarded as conclusive, as any other variety might have done equally well on the same field. From observation of the standing crops for the past two years Yeoman stands first, with Victor a good second. The former is more in favour with millers and the straw appears to stand better than that of Victor under stress of wind and weather. Good returns have also been obtained from the Old Norfolk Grey Chaff. On the other hand Swedish Iron was given up in the past season, as on this land it produced a coarse thick-skinned sample not at all liked by millers, while Little Joss and Benefactor have been discarded owing to an apparent lack of strength in the straw. Until this season Red Byrell had also been grown, but it has not found favour on the settlement.

Mustard Growing.—Mustard grown under contract is a popular crop in the district and has been extensively grown on the settlement; but with a drop in price from £12 per quarter two years ago to £4 16s., which is the offer for next season's crop, it is questionable if it is a paying proposition compared with wheat, even at 40s., in view of the latter's less costly harvesting and threshing.

Grass Land.—The grass land is not of the first quality, as feeding bullocks need help to bring off fat; neither is it suitable as a whole for young stock. The rougher pastures, however, appear to respond well to treatment, such as heavy winter dragging and the application of slag and other phosphates.

Pig Keeping.—Pigs are a strong feature on the settlement, some sixty breeding sows being kept. The Large Black is the principal breed, and intercrossing is also carried out with Middle White boars for the production of porkers, and Large Black boars on Large White sows for bacon. It is intended now to keep pedigree stock of both the Middle White and Large Blacks.

Farm Equipment.—The farm buildings have been thoroughly repaired since the Ministry took them over and useful alterations and additions have been effected. Dutch barns having been erected on three of the farms. The private roads, which run to a considerable length, have been repaired, and the more important ones, linking up different portions of the Estate, which were almost impassable clay tracks, have been macadamised at considerable outlay. Water has been laid on from the Hull Corporation mains to all the cottages, buildings and yards, also to some of the grazing fields; and the settlement as a whole is

now well laid out and equipped. With these facilities for working, it is hoped that the settlement may institute minor innovations that will further agricultural interests in the district; and there is little doubt that any practical advantages shown to result will be readily taken up and acted upon.

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POTATO LIFTING MACHINERY.

It is proposed in this article to present what, from the farmer's point of view, are the most important results contained in the recent Report* on potato lifting machinery. The Report is mainly concerned with the third of a series of trials of potato lifting machinery conducted at the Manor Farm, Garforth, by the Authorities of Leeds University, acting in conjunction with the Ministry, but it contains also a summary of results previously obtained. The first investigation was carried out by the University in 1916 and showed that when horse labour cost 2s. 6d. a day, men 4s., women 3s. 6d. and boys 2s. 6d. a day, the cost of harvesting potatoes by hand was 13s. 8d. per ton as compared with 4s. 8d. when a potato-lifting plough was used. The acreage costs were £6 16s. 8d. and £2 6s. 6d. respectively, a difference of £4 10s. 2d. an acre in favour of the plough. In 1919 an investigation was made into the comparative efficiency of a digger plough, a rotary machine and a machine of the elevator type. The cost of harvesting on that occasion came out at 7s. 11d., 6s. 11d. and 8s. 10d. per ton and £3 0s. 3d., £2 11s. 6d. and £3 0s. 6d. an acre respectively.

The investigation in 1921 was on a much larger scale and included 10 machines in all, 7 of the rotary type, 2 of the elevator type, and a combined lifting, sorting and bagging machine. It was not thought necessary to include a digger plough on this occasion. Both the economic and the mechanical aspects of the problem were investigated: i.e., the actual cost of lifting potatoes by various devices was determined, and engineering and mechanical data were collected with a view to studying the principles embodied in each machine.

* "The Use of Implements in the Lifting of the Potato Crop." 1921: University of Leeds and the Yorkshire Council for Agricultural Education, price 2s. 6d.

The Report divides potato-lifting machinery into the following four groups :—

(1) **The Plough Group** which embodies an elementary principle based largely on the ordinary plough. A plough standard carries a broad square-pointed share which runs under the tubers and lifts them up to the first set of raisers consisting of steel prongs set so as to offer resistance to the earth and potatoes. The earth is broken up and the smaller particles allowed to fall through while the larger clods and potatoes are raised to the surface. A second set of raisers catch the potatoes as they fall from the first and further separate them from the soil.

(2) **The Rotary Type** has a scoop share which runs underneath the potato ridge. The soil with the potatoes is removed by a series of rotary arms at the rear, driven at right angles to the track of the machine, which throw the soil and potatoes clear, leaving the potatoes on the surface. There are two principal types of rotary diggers :—

(a) In which the tines radiate directly from the driving spindle:

(b) In which the tines radiate from the spinner by being attached to a system of links and bars, and thus describe an elliptical path which at the bottom conforms practically to the shape of the share.

(3) **The Elevator Type** embodies the principle of a share or scoop which raises the potato ridge on to a long moving elevator which shakes out the soil. The haulm is thrown off by agitating forks at the top of the elevator and the potatoes are thrown clear of the machine to the rear.

(4) **The Combined Type** of machine was brought from Norway specially for the test. It combines the elevator and rotary principles, and is able to separate the soil and haulm by a series of grids and screens and to collect the potatoes in bags at the rear. The potatoes are sorted out into their different sizes, stones are also separated from the potatoes by a series of moving gravity traps which permit the heavier objects to fall to the ground, whilst the potatoes pass along the elevator into the sack.

The field set apart for the trial was permanent pasture until 1918 when it was ploughed out. The cropping was oats in 1918, wheat in 1919, barley and oats in 1920, followed by potatoes in 1921. The turf had become thoroughly disintegrated and did not interfere with the work of the machines. Part of the area was level but at one end of the plots there was a rather steep gradient which enabled the efficiency of the machines to be studied not only on the flat but also on the up and down

gradients. The soil was typical light coal-measures land and was in good condition for potato growing. The variety of potatoes grown was Great Scot and the crop was in excellent condition for lifting; there was a little second growth but not sufficient to interfere with lifting operations.

For the mechanical part of the investigation dynamometer readings were taken of both digging and road tests, the main factors observed being:—(1) Weight of machine in relation to drawbar load and mechanical efficiency; (2) Ease of handling; and (3) Mechanical construction, having regard to simplicity and access to wearing parts.

For the purpose of obtaining comparative costs, plots containing 12 rows of potatoes ($\frac{1}{16}$ acre in extent) were marked out and each machine was required to work both ways in order to ascertain the effect of the gradient on the work done. The number of pickers was varied, where necessary, so as to keep pace with each machine. After the plots were dug and picked they were harrowed four times and records taken of the quantities of potatoes brought to the surface. A square rod was then forked over by hand in order to ascertain the weight of tubers finally left in the ground. The main factors observed for judging the machines from an economic point of view were:—

- (1) Cost of fuel, lubricants and general upkeep;
- (2) Labour, amount and cost;
- (3) Percentage of damaged tubers;
- (4) Work required after digging operations, such as harrowing;
- (5) Proportion of total crop finally left in the ground;
- (6) Working costs per plot and per acre;
- (7) Quantity of work done; and
- (8) General adaptability for any other work.

The following is a summary of the results contained in the Report:—

(1) **Bamlett Improved Potato Digger (Link Type)**, manufactured by Messrs. A. C. Bamlett, Ltd., Thirsk.

Summary of Results.

					T.	cwt.	qr.	lb.
Total weight lifted	...	...	...	per plot	2	4	0	0
Total weight of harrowings	...	...	...	"	0	3	0	3
Total weight damaged	...	...	...	"	0	0	0	24
Estimated weight left in ground	...	...	...	"	0	2	2	10
Total cost per acre	...	...	...	...	£2 11 7			
Cost per ton of saleable ware and seed lifted	...	...	...	...	£0 8 9			
Total net returns per acre from all tubers lifted	...	...	...	...	£39 10 9			
Speed of travel in miles per hour	...	...	...	...	3.4			
Average distance potatoes thrown	...	...	...	...	4 ft. 3 in.			
Maximum distance potatoes thrown	...	...	...	...	12 ft. 0 in.			
Drawbar load in work	...	...	...	...	372 lb.			

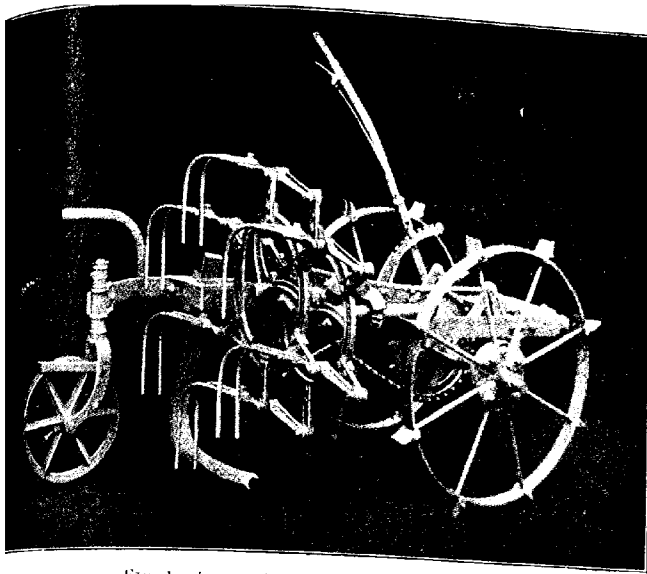


FIG. 1.- Improved Potato Digger (Link Type).

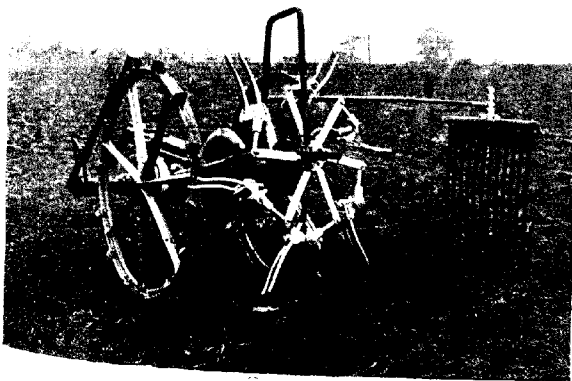


FIG. 2.- Potato Raiser (Link Type).

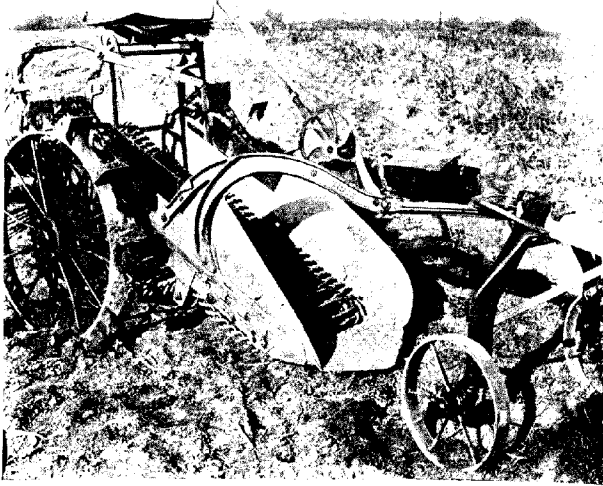


FIG. 3.—Potato Digger (Elevator Class).

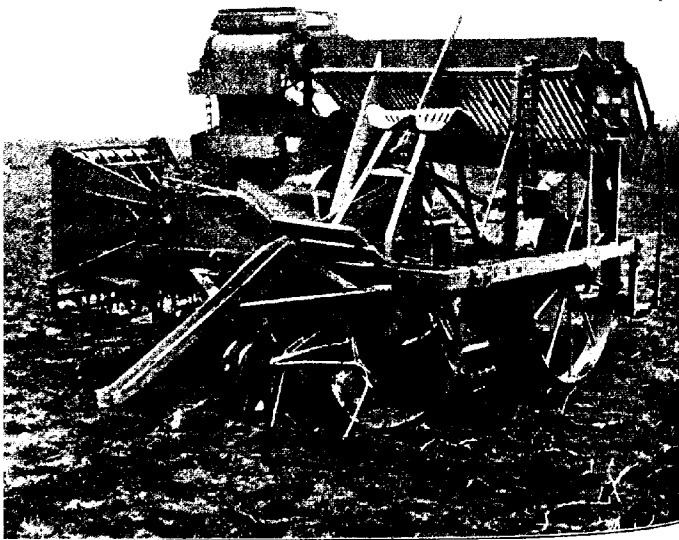


FIG. 4.—Combined Lifting and Bagging Machine.

The Barnlett Machine used the low-speed sprocket, and the net working time for the plot was 17½ minutes, including two short stoppages of a few seconds each to clear the lower edge of the screen of tops and to clean the share. Hardly any choking of the spinner and share was observed. The lifted potatoes were left in a row about 4 ft. in width. A large number of the potatoes were found at the outside of the row where they had been stopped by the screen. This uneven distribution, however, did not handicap the pickers to any great extent, as the tubers were fairly well exposed. Where the tops were strong the screen turned these back over the potatoes at the outer edge of the row, and though in the particular crop used for the test this was not serious, yet in a crop with strong growing tops it might prove troublesome by covering up the tubers.

(2) **Jack's Imperial Potato Raiser (Link Type)**, manufactured by Messrs. A. Jack and Sons, Limited, Maybole.

Summary of Results.

		T. cwt. qr. lb.
Total weight lifted	per plot	2 5 2 26
Total weight of harrowings	"	0 2 1 8
Total weight damaged	"	0 0 0 15
Estimated weight left in ground	"	0 2 0 8
Total cost per acre		£3 8 6
Cost per ton of saleable ware and seed lifted		£0 10 0
Total net returns per acre from all tubers raised		£40 1 6
Speed of travel in miles per hour		2.1
Average distance potatoes thrown		5 ft. 0 in.
Maximum distance potatoes thrown		12 ft. 0 in.
Drawbar load in work		479½ lb.

The action of this machine was more violent than the other types, and although a screen was used which restricted the width of spread of the bulk of the crop to 5 ft., some of the tubers which did not strike the screen were thrown a distance of 12 ft. They were, however, all fairly well exposed for picking. At the third row the screen, which had been set to trail on the ground and was latched to the tractor to prevent it swinging, became clogged with tops and a short stoppage was necessary to clean and raise it. The net working time for the plot was 27½ minutes. There was a tendency for the tops to cling round the spindle of the machine and the centre of the spinner, and these had to be cleared when opportunity occurred at the headlands. Speed was reduced in the last six rows, which proved more satisfactory as the tubers were then not scattered so far and were also well exposed.

(3) **Jack's Caledonian "A" Potato Raiser (Rotary Type)**, manufactured by Messrs. A. Jack and Sons, Limited.

Summary of Results.

		T. cwt. qr. lb.
Total weight lifted	per plot	2 5 2 22
Total weight of harrowings	"	0 3 1 15
Total weight damaged	"	0 0 0 24
Estimated weight left in ground	"	0 2 0 8
Total cost per acre		£3 3 9
Cost per ton of saleable ware and seed lifted		£0 9 8
Total net returns per acre from all tubers raised		£40 14 10
Speed of travel in miles per hour		2.5
Average distance potatoes thrown		4 ft. 6 in.
Maximum distance potatoes thrown		6 ft. 0 in.
Drawbar load in work		441½ lb.

The action of the Caledonian "A" spinner was less violent than that of the Imperial, but the screen was again necessary to control the spread of the potatoes to 5 ft. The tubers were not, however, quite so well exposed. The tops tended to twine round the spindle as in the case of the Imperial. The net working time for this machine was $25\frac{1}{2}$ minutes for the plot, including one minute for adjusting the screen and digger.

(4) **Jack's Caledonian "B" Potato Raiser (Rotary Type)**, manufactured by Messrs. A. Jack and Sons, Limited.

Summary of Results.

				T. cwt. qr. lb.
Total weight lifted	... ..	per plot	2	2 1 17
Total weight of harrowings	... ..	"	0	3 0 15
Total weight damaged	... ..	"	0	0 2 4
Estimated weight left in ground	... ..	"	0	3 0 12
Total cost per acre	... ..		£2	14 10
Cost per ton of saleable ware and seed lifted	... ..		£0	9 2
Total net returns per acre from all tubers lifted	... ..		£37	17 6
Speed of travel in miles per hour	... ..			3.0
Average distance potatoes thrown	... ..		4	ft. 0 in.
Maximum distance potatoes thrown	... ..		6	ft. 0 in.
Drawbar load in work	... ..			474 lb.

The net time taken for this plot was 21 minutes, which included two stoppages of 30 and 60 seconds respectively for slight adjustments. As with the "A" type, the spinner action was less violent than the Imperial, but the potatoes were not left so well exposed. The tops, however, were thrown wide and did not tend to twine around the spindle, as was the case with the other machines of this make.

(5) **Martin Potato Digger (Link Type)**, manufactured by Martin's Cultivator Company, Limited, Stamford.

Summary of Results.

				T. cwt. qr. lb.
Total weight lifted	... ..	per plot	2	3 3 18
Total weight of harrowings	... ..	"	0	3 3 25
Total weight damaged	... ..	"	0	0 1 5
Estimated weight left in ground	... ..	"	0	0 1 1
Total cost per acre	... ..		£2	13 2
Cost per ton of saleable ware and seed lifted	... ..		£0	8 9
Total net returns per acre from all tubers raised	... ..		£42	8 10
Speed of travel in miles per hour	... ..			3.1
Average distance potatoes thrown	... ..		4	ft. 3 in.
Maximum distance potatoes thrown	... ..		9	ft. 0 in.
Drawbar load in work	... ..			451 lb.

The net working time for this plot was $18\frac{1}{2}$ minutes, which included only one stoppage of 10 seconds to clear the share. The potatoes were left in a row having an average width of 4 ft. 3 in., but were not so well exposed as when lifted by other rotary machines. The first row was dug at too great a speed, and consequently the tubers were scattered up to a distance of 9 ft. In the second row, which was dug at a slower speed, the spread was 6 ft. It was found that with a high speed the potatoes were spread up to 9 ft., but were cleanly exposed and were easily gathered. When the speed was lowered a spread of only 5 ft. was obtained, but the potatoes were not fully exposed, particularly on the side of the row next to the machine.

(6) **The Powell Potato Digger (Link Type)**, manufactured by Messrs. Powell Bros., Limited, Wrexham.

Summary of Results.

		T. cwt.	qr.	lb.
Total weight lifted	per plot	2	5	2 0
Total weight of harrowings	"	0	2	3 24
Total weight damaged	"	0	0	0 18
Estimated weight left in ground	"	0	2	0 8
Total cost per acre		£3	14	5
Cost per ton of saleable ware and seed lifted		£0	10	7
Total net returns per acre from all tubers lifted		£39	3	0
Speed of travel in miles per hour				2.7
Average distance potatoes thrown			5 ft.	9 in.
Maximum distance potatoes thrown			12 ft.	0 in.
Drawbar load in work				363 lb.

The actual time taken for this plot was 27 minutes, which included seven short stops for cleaning the share. The potatoes were very well exposed, except immediately alongside the path of the machine, and were evenly distributed in a row of from 5.6 ft. wide, but occasional tubers were thrown to a distance of 8 or 10 ft. and even 12 ft. The speed of the machine was reduced for the last seven rows of the plot, and as a consequence the tubers were then thrown up to a distance of about 5 ft., but they were not quite so well exposed as previously.

(7) **Ransomes' No. 12 Potato Digging Machine (Link Type)**, manufactured by Messrs. Ransomes, Sims, and Jefferies, Ltd., Ipswich.

Summary of Results.

		T. cwt.	qr.	lb.
Total weight lifted	per plot	2	4	3 1
Total weight of harrowings	"	0	2	2 0
Total weight damaged	"	0	0	2 4
Estimated weight left in ground	"	0	1	3 8
Total cost per acre		£3	0	6
Cost per ton of saleable ware and seed lifted		£0	9	7
Total net returns per acre from all tubers raised		£40	2	8
Speed of travel in miles per hour				2.7
Average distance potatoes thrown			3 ft.	3 in.
Maximum distance potatoes thrown			4 ft.	0 in.
Drawbar load in work				455 lb.

The actual working time of this machine was 22 minutes for the plot, including one stoppage at the end of the first row to lengthen and adjust the draught chain. A slight delay of a few seconds each time was occasioned by the necessity of cleaning the share at the end of each row.

The machine left the tubers well exposed and evenly distributed in a row of from 3 ft. to 3 ft. 6 in. wide, no potatoes being thrown to a greater distance than 4 ft.

(8) **The Hoover Potato Digger (Elevator Type)**, manufactured by the Hoover Manufacturing Co., Avery, Ohio, U.S.A., and represented by British Hart Parr Company, 93, Lincoln Road, Peterborough.

Summary of Results.

		T. cwt.	qr.	lb.
Total weight lifted	per plot	2	0	3 18
Total weight of harrowings	"	0	1	2 14
Total weight damaged	"	0	0	3 27
Estimated weight left in ground	"	0	3	1 13
Total cost per acre		£2	16	1
Cost per ton of saleable ware and seed lifted		£0	9	3
Total net returns per acre from all tubers lifted		£37	11	5

Speed of travel in miles per hour	...	...	...	2.8
Average width potatoes deposited	...	...	...	1 ft. 6 in.
Drawbar load when lifting	...	...	...	810½ lb.

For this machine a British Wallis Tractor was employed. The net working time for lifting the plot was 24½ minutes, which included stoppages of 30 seconds for adjusting the shovel, three minutes for re-adjusting the drawbar, and short intervals to relieve the machine of tops which had choked the elevator. The tubers were left in a row varying from 1 ft. 3 in. to 1 ft. 9 in. in width, this narrow width being very convenient for picking. Generally speaking the potatoes were well exposed but some were covered by tops, which were not always thrown clear as is intended by the agitating forks at the top of the elevator of this machine. The manner in which this machine leaves the potatoes renders it essential that the tubers of one row must be picked before another is lifted, otherwise the right hand tractor wheels would travel over the tubers of the previous row. As this machine continues to scatter tubers for some 6-8 ft. after completing the row (the tubers at the end of the row raised by the scoop have to travel up the elevator and drop behind the machine by the shakers) it is advisable to have a clear space at the ends of the drills to facilitate picking and also for the tractor to continue in its line of travel before turning. An advantage with this machine is that the potatoes are left in a narrow row after being raised, with the tops placed to the extreme left but not covering them, which greatly facilitates picking.

(9) The "Star" Potato Digger, manufactured by the Cleveland Implement Manufacturing Company Alliance, Ohio, U.S.A., represented by Messrs. Isherwood and Young, 57, Cheapside, E.C.2.

Summary of Results.

					T.	cwt.	qr.	lb.
Total weight lifted	...	...	...	per plot	1	19	1	0
Total weight of barrowings	...	...	...	"	0	3	1	24
Total weight damaged	...	...	...	"	0	1	2	0
Estimated weight left in ground	...	...	...	"	0	10	1	21
Total cost per acre	...	...	...	...	£3	9	4	
Cost per ton of saleable ware and seed lifted	...	...	...	...	£0	11	10	
Total net returns per acre from all tubers lifted	...	...	...	...	£26	4	9	
Speed of travel in miles per hour	...	...	...	...				2.5
Average width potatoes deposited	...	...	...	...				1 ft. 6 in.
Drawbar load when lifting	...	...	...	...				866 lb.

The "Star" like the "Hoover" was drawn by the British Wallis Tractor. Its net digging time for the plot was 29½ minutes, including stoppages of 1½ minutes to alter the tractor hitch, of five minutes to adjust the driving chain of the main elevator which had worked off and to clear the tops which clogged the machine, with other short intervals. There were a number of stoppages whilst digging the second half of the plot owing to the scoop being set more deeply in the ridge in order to avoid slicing the potatoes. It is evident that the elevators were not of sufficient width to deal effectively with the amount of soil which was raised when the scoop was set sufficiently deep to raise the whole of the tubers of the crop.

The potatoes were left in a narrow row of about 1 ft. 6 in. in width in the rear and in the line of travel of the machine, but were not well exposed as a considerable amount of soil and tops dropped with and on top of them. Consequently more pickers had to be employed than with the Hoover.

(10) **The Haug Combined Lifting and Bagging Machine:** manufacturers' agent, Mr. Th. Jespersen, c/o Messrs. Baddon and Arton, 45, Chancery Lane, London, W.C.2.

Summary of Results.

	T.	cwt.	qr.	lb.
Total weight lifted	2	6	0	22
Total weight of harrowings	0	0	3	14
Total weight damaged	0	3	0	20
Estimated weight left in ground	0	4	1	18
Total cost per acre	£4 10 1			
Cost per ton of saleable ware and seed lifted	£0 13 2			
Total net returns per acre from all tubers lifted	£32 1 1			
Drawbar load when lifting	1,293 lb.			

The Haug Machine only lifted one half of the plot allotted to it, but the figures have been doubled to permit of easier comparison. The machine, which was in an experimental stage, proved quite unsuitable for English conditions, and at the end of six rows the owner withdrew it from the investigation.

Conclusions.—Whilst it is not possible to base exact conclusions on some of the data contained in the Report, it is possible to make some general deductions so far as groups of machines are concerned.

Plough Group.—The investigation of 1916 showed that the use of an ordinary potato-lifting plough resulted in a saving of £4 10s. an acre as compared with hand forking and it would appear that a grower of at least one acre of potatoes would be well advised to use such an implement rather than hand labour for lifting the crop.

Rotary Group.—In these trials the marked superiority of this type of machine over the other types is shown (1) by the fact that the net profit realisable per acre from the potato field in question amounted to an average of £39 19s. 10d. when lifted by the rotary machine; £31 18s. 2d. by the machines of the elevator type; and £32 1s. 1d. when lifted by the combined type. (2) by the fact that when the ten machines are arranged in order of merit according to costs, the seven machines of the rotary type come first, and when arranged in order of merit according to their mechanical efficiency the first six are all of the rotary type. The minimum area upon which the rotary type can be economically employed is about 5 acres.

Elevator Type.—All the conditions in the test were ideal for the efficient working of this type and had the soil conditions been only slightly worse the performances would have been still poorer. The only advantageous point in these machines is the manner in which the potatoes are deposited after lifting, *i.e.*, in a very narrow row. The general performance, however, reflects badly on this type, when the quantity of potatoes left in

TABLE I.
COMPARATIVE PERFORMANCE AND COST.

[illegible]

the ground, the percentage damaged, and the quantity of harrowings are examined. The cost of picking constitutes, on the average, well over 40 per cent. of the total cost of lifting, and when the results obtained by this type are examined, it will be seen that the cost of picking alone falls considerably below the corresponding figures for the rotary type of machine. The tractor load is heavy and out of proportion to the work done in comparison with the rotary type. The shovel does not avoid damaging the potatoes and is certainly no more effective in lifting the drill than the share and revolving tines of rotary machines.

The Combined Type.—This type offers a very wide and extended field of investigation and the high cost of bagging and picking with machines at present employed shows that there is scope for any device which will displace hand labour. For every £5 15s. expended in lifting and sorting the crop, £4 was expended in picking, sorting and bagging. If these operations can be dispensed with by the use of the combined type there is a possibility of saving up to 70 per cent. of the cost of harvesting and marketing potatoes. No machine of this type has yet been sufficiently developed to justify its use.

Finally, it must be remembered that the results set out above were obtained for machines working under good conditions of soil and weather for a few days only and that due allowance must be made for these facts in judging the suitability of a machine or method for different soil or climatic conditions. It may be accepted, however, that under worse conditions the more complicated the machine the greater would be its handicap and this would increase as the working conditions became worse. This might result in a potato-lifting plough, for instance, being more economical on very heavy land or under adverse weather conditions than a rotary machine for an area in excess of five acres, but it is inconceivable that a machine of the elevator or combined type would be successful in unfavourable conditions which had proved too much for a rotary machine. In extreme cases it might be best to use a ridging plough or even hand labour.

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WILD ANIMALS OF THE FARM: THE WILD RABBIT.

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THERE seems to be good reason for believing that the Wild Rabbit lived in England before the Great Ice Age, that it was exterminated during that time of sifting, and that it was re-introduced—probably from the Mediterranean region or Spain. There is no doubt that its introduction into Scotland and Ireland is comparatively recent. Indeed, it was not known in Scotland before the thirteenth century, and there are many places north of the Tay which it did not reach till the nineteenth. But while it does not like severe cold, as in Scandinavia, it has an adaptable constitution and flourishes only too well in a great variety of places from Ireland to Australia.

Enemies.—The Wild Rabbit has no end of enemies, from man to rats, and yet it holds its own with ease. Against it are foxes, stoats, badgers, cats, hawks and owls, ravens and crows, and more besides, yet its ranks are not thinned. In what ways does it secure survival? Not because of its wits, for it is not a clever creature, and its brain is very smooth. Not because of its weapons, for its teeth are not suitable for biting (though it occasionally bites both man and dog in the extreme of its desperation), and it cannot give such a formidable back-kick as the hare is able to deliver.

Fertility.—The first reason for the rabbit's success is its fertility. It is ready to breed at six months; it may have six litters between February and September; the period of antenatal life is just about four weeks; there may be five to eight young ones in a litter. There is often considerable infantile mortality, for if the burrow gets very damp some of the young ones are apt to die of paralysis, and there is often the chance of a fatal visit from a brown rat. After they emerge into the open the young rabbits are often picked off before they learn to find their way about. Counter-balancing all these chances of death there is the prodigious fertility.

Appetite.—A second reason for the rabbit's success is its catholicity of appetite, and this rivalry touches man on the raw. For besides grass which is the staple food, rabbits are fond of cereals, turnips, bark, and garden vegetables. They eat the young

shoots of furze and bracken, and, from the agricultural point of view, that is to the plus side of the account; but everyone is aware of their very serious depredations in farm and garden. There are many curiosities of diet, *e.g.*, birch leaves, laurel bark, and rhododendron, but these are neither here nor there except in indicating that the rabbit has many resources. A little detail which is quite characteristic of the difference between rabbit and hare is that the rabbit eats the whole turnip, whereas its cousin—a dainty feeder—leaves the rind.

Burrowing Habits.—A third factor in the rabbit's survival is to be found in its burrowing habits. When animals long ago left the water and took to terrestrial life, they left behind them the freedom of movement which aquatic conditions afford, and they were restricted to movement in one plane—the surface of the earth. This restriction involved increased danger, which had to be met by greater rapidity and precision of movements, implying improvements in the nervous system and the musculature. But another way out of the difficulty was to gain the power of flight as birds did, or to become arboreal as some squirrels have done, or to return secondarily to the water as in the case of otters, or to become burrowers like the rabbits. The burrow may be only a yard deep, but it is often much more; it may have various branches and more than one doorway. It is a life-saving retreat.

A Twilight Feeder.—Another factor in success is in itself a confession of relative failure: the rabbit is in great part a twilight animal. Except when there is a tradition of great safety, rabbits tend to rest through the day and to reserve their feeding and their frolics for the dusk. It is then that the white tail, flicked up by the seniors, gives the inexperienced youngsters a lead in finding the burrow as quickly as possible. In the darkness there is also advantage in having well-trodden paths or runways, though man utilises these in setting snares.

Sociability.—Another useful quality is sociability. Rabbits are in this respect to the hare as rooks to a crow. They are pleasantly playful and the social note is sounded in the quaint danger-signal which they make by thumping on the ground with their hind legs. Compared with most gregarious animals, they have little voice, for it hardly rises above a whisper on ordinary occasions. They utter a grunt of contentment when pleased and this is sometimes used as a call-note. Their scream of terror when the stoat overtakes them is of course pathological.

Care of the Young.—Yet another factor in survival is the care of the young. The nest at the far end of the burrow is made cosy with soft hair pulled by the mother from her coat.

The young ones, blind for eleven days, with closed ears for twelve, and quite naked to start with, are nursed very faithfully; a dead one is removed and hidden; the door of the burrow may be closed up when the mother has to go out.

Timid as she is, the mother will occasionally fight for her offspring. She will move them from a place of danger to a place of supposed safety, just as a cat will her kittens. And very important is the period of education which begins when the young are able to leave the burrow. They have a great deal to learn and their mother is a good teacher.

It seemed of interest to discuss the Wild Rabbit from this particular point of view—how does it survive? The answers are because it is prolific, with a wide range of appetite, a burrower, crepuscular, sociable, maternal, and a good teacher. Of course that is not quite all—there is the keen sense of smell, for instance—but it must suffice; for there are some other questions to be considered.

Promiscuous Pairing.—There are well-authenticated cases where a pair of rabbits keep to monogamy for a year at least, but that is not the way with the majority. Polygamous is too mild a word; promiscuity is the rule. In this connection we must notice Rodier's plan for dealing with the Australian rabbit pest. He suggested that does should be killed in as large numbers as possible, but no bucks. The *local* result was that the bucks killed the helpless young, and the polyandry that set in became so intense that the females perished in large numbers. They were persecuted to death by the demands of the bucks. How far the plan has worked over large areas we do not know.

Rabbits were introduced to Australia about 1850, and in the absence of their usual enemies they multiplied exceedingly, turning enormous tracts of useful soil into desert. Many checks have been tried, but the rate of multiplication seems to defy all expedients. The only hope of permanent relief, and that not a very brilliant one, is the increase of the agricultural population. But it is almost a vicious circle.

Teeth.—A typical Wild Rabbit is about seventeen inches long and three pounds in weight. Like the hare, and unlike other rodents, it has two pairs of upper incisors, the smaller pair behind the larger. On the lower jaw there is as usual a single pair of incisors. These front teeth go on growing persistently—

an adaptation to counteract the continual wearing away at the chisel-edged tips.

It occasionally happens that the upper and lower front teeth do not meet one another with precision, and then the persistent growth of the teeth may prove fatal, though it is extraordinary what a rabbit can stand in the way of dental malformation. The chisel-edge is produced automatically because the very hard enamel is confined to the front and does not wear so quickly as the relatively softer ivory behind. In the process of eating it may be observed that the lower incisors work against the back part of the front upper incisors, and on the surface of the blunt hidden second pair of incisors. There are of course no canines, and the furred sides of the cheeks project into the mouth between the incisors and the back teeth, which are suited for grinding. In rodents that gnaw much more than they wish to swallow, the non-edible material does not get past the front part of the mouth. The munching movements in eating seem to have given rise to a belief among country people that the rabbit chews the cud.

The Fur.—It is interesting to peer into the grizzled greyish-brown fur of the Wild Rabbit to see what a subtle mixture it is. Students of heredity have shown that numerous "factors" go to the making up of this really beautiful fur, and that the dropping out of one or several of these in the maturing of the germ-cells may result in a colour-variety. So have arisen in domestication the blacks and whites, yellows and "blues," and other colours—all derived from the Wild Rabbit's fur. Should these varieties, which man keeps apart, inter-breed, there must eventually be in the progeny a return to the Wild Rabbit type of coloration. Items that have been separated out come together again. The Wild Rabbit has evidently great possibilities of change, for it has supplied the material out of which man has established Angoras, Lop-Ears, "Belgian Hares," Flemish Giants, and so forth. Small variations occur in natural conditions, but they come to nothing, apparently because the Wild Rabbit is well adapted to survive just as it is at present.

Injury and Use.—The circle of the Wild Rabbit's life cuts into man's. They do great damage by devouring field-crops and garden-produce. They often smother good grass with the material thrown out from their burrows. They foul the grass so that sheep will not eat it, and the hare also sniffs and turns away. They destroy young trees by cutting off a ring of bark a little above the ground. There is, indeed, something on the plus side. They afford useful fur and palatable flesh: we have noticed

that they check the spreading of gorse and bracken; and they make the most perfect golfing turf in the world. But even their best friends will admit that Wild Rabbits frequently outrun all reasonable bounds.

* * * * *

THE ECONOMICS OF WINTER AND SUMMER MILK PRODUCTION.

JAMES WYLLIE, B.Sc., N.D.A. (Hons.), N.D.D.

THE production of milk in this country is carried on under highly diverse conditions which vary from farm to farm as well as from district to district; there is also considerable variation in the method of disposing of the milk. At the one extreme we have the "town-dairy," where all the cows are purchased, kept for only one lactation and then sold to the butcher, the milk being sold direct to the consumer; at the other, the purely cheese-making farm, where all the cows are home-bred, kept for three to six lactations and then sold, the milk being made almost entirely into cheese. In the former case, all the feeding stuffs are purchased and the manure sold; in the latter, the greater part of the food is home-grown and the manure is returned to the land. In the former, the cows calve, or are purchased newly calved, so as to maintain a fairly uniform monthly output throughout the year; in the latter, all the cows calve in the spring, there is a "flush" of milk for about three months after calving and practically none for about three months in the winter.

Systems of Milk Production and Disposal.—Apart from town-dairying, the systems of milk production may be classified as follows:—

Group A. Milk Selling.—(1) Cows calve all the year round and the monthly output of milk is fairly uniform, but highest during the months of April to July. (2) Cows calve chiefly in the spring, and the monthly output is much greater from April to July than during the rest of the year.

Group B. Milk Selling and Cheese-making.—(1) Cheese made or milk sold according to economic conditions (relative prices of milk, cheese, pigs, etc.). (2) Cheese made from March or April to September or October, and milk sold during the rest of the year. In both cases, the cows calve chiefly in the spring, and the monthly output of milk during the winter months is comparatively small.

Group C. Butter-making.—Most of the milk is made into butter.

Group D. Cheese-making.—Most of the milk is made into cheese (These last two groups are relatively unimportant).

Further, the milk that is sold by the farmer may be disposed of (a) direct to the consumer, (b) to a retailer, (c) to a wholesaler, or (d) to a creamery, milk depot or milk factory. In the first three cases, most of the milk will be consumed as whole or "fresh" milk, but in the last case it may be re-sold to a retailer or wholesaler for consumption as fresh milk or made into cream, butter, cheese, dried or condensed milk, etc.

It should also be remembered that from the economic point of view, cheese-making and the breeding and feeding of pigs are intimately associated, while the same applies to butter-making and the sale of buttermilk, or the rearing of calves and pigs. Further, the price of fresh milk—and therefore its production—is affected by the imports of butter, cheese, dried and condensed milk.

The above classification is, however, by no means rigid, and is much less so than it was even twenty years ago, i.e., the farmer has a greater choice as to how he can best dispose of his milk and therefore as to the system which he can most profitably follow. In the main, this is due to the introduction of (1) creameries, milk depots and milk factories, (2) motor transport* and improved railway milk vans, and (3) refrigerators and pasteurising plants. The general effect of these innovations is to increase the potential supply of fresh milk, not only absolutely but also relative to the total output.

Irregular Output of Milk.—In view of such wide variations, it is not surprising that the organisation of the milk industry upon national lines involves numerous problems which so far have not been successfully solved. Perhaps the fundamental difficulty arises out of the irregularity in the monthly output—an irregularity the degree of which varies considerably from district to district and from farm to farm in the same district. Roughly speaking, what happens at present is a glut or surplus of milk in the late spring and summer months, accompanied by relatively low prices for fresh milk, and a shortage during the winter months, accompanied by relatively high prices.

Until recently, the main efforts have been directed towards the utilisation of the surplus production by means of creameries, milk factories, etc., but it would appear that in the agreements made in the autumn of 1922 between the producers' and

* Compare *Scottish Farmer*, 11th November, 1922, p. 1386 :—"Motor traction has contributed greatly to the modification of dairying methods in Arundale. Hardly a cheese-making dairy in the whole area now. Milk nearly all goes to Glasgow by motor."

the distributors' organisations both in England and in Scotland, direct encouragement is given towards the removal of the surplus by transferring milk to the winter months, *i.e.*, one object of these agreements is to obtain a more regular output throughout the year. It is commonly stated that the consumption of fresh milk in this country is much too low for the national welfare, and if this be so it seems rather strange that we should hear so much about surplus production.

Actual statistical evidence of this irregularity in output is somewhat incomplete, although its existence cannot be questioned: indeed, there is a tendency to look upon it as one of the "incurable ills" of the milk producer. In order to give some idea as to the degree of irregularity which obtains the following data may be quoted:—

VARIATION IN MONTHLY OUTPUT OF MILK.

(1) <i>Scottish Milk Report</i> .*		<i>Astor Milk Committee Report</i> .†	
Period (4 weeks)	Per cent. of Total Output.	Month.	Per cent. of Total Output.
1920-21			
May 16—June 12	8.9	May	10.8
June 13—July 10	9.8	June	11.8
July 11—Aug. 7	8.9	July	10.3
Aug. 8—Sept. 4	8.0	Aug.	9.8
Sept. 5—Oct. 2	7.2		42.7
		Sept.	9.1
Oct. 3—Oct. 30	6.7	Oct.	8.3
Oct. 31—Nov. 27	6.4	Nov.	7.1
Nov. 28—Dec. 25	6.1	Dec.	5.9
Dec. 26—Jan. 22	6.6		30.4
		Jan.	5.9
Jan. 23—Feb. 19	7.1	Feb.	6.0
Feb. 20—Mar. 19	7.6	Mar.	6.9
May 20—Apr. 16	7.9	April	8.1
Apr. 17—May 14	8.5		26.2
	100.0		100.0

In the first case, the data were obtained by the writer in an investigation into the cost of milk production in Scotland for the year ended 14th May, 1921, and are the average results from thirty-two farms, nearly all of which belonged to Group A (1) above. These are therefore actual results for these farms for that year. In the second case, the data are taken from the Astor Milk Committee Report and are estimates, based upon all the evidence available, of the relative monthly output for the whole of Great Britain during the years 1917-18. It will be noticed that, as would be expected, the variation is

* Report to Board of Agriculture for Scotland on an Investigation into the Cost of Milk Production.

† Final Report of Committee on the Production and Distribution of Milk. (Cmd. 438, 1919).

much greater in the second than in the first set of figures. Further, the final report of the Travelling Milk Commission* contains the results of a census of milk production taken by the Ministry of Food for the week ended 2nd June, 1918, and again for the week ended 7th December, 1918. In the week first mentioned the total milk production for Great Britain was estimated to be about 27.8 million gallons whereas in the second week it was only about 13.7 million gallons.

By way of contrast, take an example from Denmark. In 1912-13 out of the total of 34,217 cows included in a certain investigation, 33 per cent. calved during October to December, 31 per cent. from January to March, 19 per cent. from April to June and 17 per cent. from July to September.†

Causes of Heavy Summer Production.—If then we are correct in our diagnosis of "irregular output" as the primary disease of the milk industry, the next step is to look for the cause, after which it will be possible to decide to what extent the disease can be eradicated, or at least alleviated.

Many explanations can be put forward—connected with the climate, soil, size of farm, labour supply, marketing facilities, likings of the farmer and so on—but in the last resort the fundamental cause undoubtedly is that each farmer follows that system of production which he believes enables him to obtain the maximum total profit from his farm. There is no reason to think that farmers have a rooted aversion to winter as against summer milk production, although it may be said that there is a widespread opinion that "winter milk" seldom pays and that the all-the-year-round producer makes all his profit during the grazing season.

Before any marked change towards increased winter production (and a more uniform monthly output) will be made, farmers must be satisfied (1) that the change is practicable i.e., from the point of view of labour supply, byre accommodation, sanitary conditions, etc., and (2) that it is likely to result in an increase in the total profit from the farm. Let us examine this last point a little closer.

A readjustment in the monthly output, if upon any considerable scale, would no doubt affect the relative monthly prices for fresh milk, in accordance with the ordinary laws of supply and demand. Thus, an increased winter output would be likely

* Cmd. 233, 1919.

† Quoted in *Journal Department of Agriculture and Technical Instruction for Ireland*, Vol. XIV, No. 4, p. 727.

to cause some lowering in the winter milk prices, while a reduced summer production might conceivably result in somewhat higher prices. Since, however, milk prices in this country are indirectly influenced by the current prices of imported cheese and tinned milks, it must be confessed that the ultimate results under this head are highly problematical. The go-ahead farmer, however, will not fail to notice that for some time at least it may be possible for him to increase his winter milk output very considerably without any reduction in price taking place. In favour of winter milk production, it is urged that a cow capable of giving 700 gallons of milk after a spring calving would be capable of at least 800 gallons after an autumn calving—for reasons into which we need not enter here. The data on this point are numerous and conclusive.* Further, the autumn calver produces a greater proportion of her milk during the months of highest prices than the spring calver. Thus, we might have :—

			Gals.	Per Gal.	Total.
					£ s. d.
Spring calver gives	...	...	700	at 1/2	40 16 8
Same cow calving in autumn gives			800	at 1/4	53 6 8
Difference in favour of autumn calver					£12 10 0

These figures are only illustrative but they serve to emphasize two important points which are apt to be overlooked or ignored. On the other hand, the autumn calving cow requires, of course, more liberal winter feeding than the spring calver. (Other costs—labour, general expenses, etc.—may also be a little higher, but for the present purpose it is sufficient to deal with the cost of feeding). Now it is generally agreed that, under ordinary conditions, winter milk production is not likely to be profitable unless there is a good supply of home-grown fodder, and of roots or silage, although the roots or silage can be replaced to a certain extent by wet brewers' and distillers' grains. If cheap home-grown oats and beans are also available so much the better. Here we can distinguish three typical cases, viz. :—

(a) On what are at present purely or mainly "grass farms," winter milk production would involve a radical change in the method of handling the land.

(b) On many farms, plenty of fodder and roots are available.

* See, for example, *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XIV, No. 4, and Vol. XVII, No. 2; *Bull.* No. XXV, Agricultural Department of University College, Reading. Compare *Journal R.A.S.E.*, 1912, p. 171, and *Trans. Highland and Agric. Soc.*, 1919, p. 250.

but these are fed largely to dry cows which are due to calve from March onwards. In this case, all that would be necessary for an increased output of winter milk would be a re-organisation of the milk production department.

(c) On other farms, again, the fodder and roots are fed to sheep and fattening cattle, as well as to dairy cows, or are partly fed and partly sold. In this case, it is a question as to the most profitable way of disposing of these crops.

In general, the change towards increased winter milk production could be most readily effected in case (b). In case (c) the question is not so much whether an increased output of winter milk would result in an increase in the total profit from milk, as whether such a change would bring about an increase in the total profit from the whole farm; it must always be kept in mind that the goal of the farmer is the maximum possible profit from the farm as a whole rather than from any particular department. Looked at from this angle, the problem is by no means so simple as at first sight it appears to be, and its accurate solution in many cases involves very careful and somewhat detailed accounting records.

At the same time, the general tendency is to lay too much stress upon the extra expense in feeding cows which are in full milk during the winter months, and to overlook or to minimise the increased yields and higher milk prices which are obtained from autumn as against spring calvers. There is also a tendency to underestimate the cost of summer grazing, especially on temporary or rotation pastures, of which rent and rates may form no more than 50 per cent. instead of almost the whole as is commonly reckoned. These tendencies are no doubt partly responsible for the existing prejudice against winter dairying. An old Scotch saying has it that, "he who counts the cost will never yoke the plough." but the fact that farmers have gone on ploughing rather suggests that the cost was not correctly counted. It is anything but a simple matter to calculate accurately the relative costs of production of winter and summer milk, and haphazard calculations are almost certain to be very wide of the mark.

Returns from Summer and Winter Milk.—The relative profits from winter and summer milk production will depend to a certain extent upon the relative market prices for winter and summer milk, and it is perhaps not sufficiently realised that if the cost of production and selling price per gallon of winter milk are both 50 per cent. higher than those of summer milk,

then the net profit per gallon will also be 50 per cent. higher, so that we might have :—

	<i>Cost of Production.</i>	<i>Selling Price.</i>	<i>Net Profit.</i>
	d.	d.	
Winter milk per gal....	18	21	<i>Threepence.</i>
Summer milk „ „ ...	12	14	<i>Twopence.</i>

It is clear that an increased output of winter milk may be obtained either by increasing the number of cows in the herd by the introduction of autumn calvers, or simply by increasing the proportion of autumn calvers in the number of cows already in the herd. In the majority of cases, the second method will probably be the more practicable, but an increase of arable dairying, which may take place under existing economic conditions, might very well take the form of relatively high winter milk production.

Now suppose that we are right in assuming that farmers do not go in more extensively for winter milk production chiefly because they think it is less profitable than summer milk production, what evidence can we produce to the contrary? Unfortunately, direct evidence, based upon actual experience, is very scanty, and however easy it might be to make out a strong "theoretical case" in favour of winter milk it is unlikely that such proof would carry much weight with the practical farmer.

A Scottish Investigation.—In the Scottish investigation conducted by the writer, which has already been referred to, complete data of both costs and returns were obtained from 28 farms distributed throughout Scotland, but chiefly in the south-west. On six of these farms the milk was retailed: on the remaining twenty-two it was sold wholesale, sixteen being farms with "breeding stocks" (i.e., all cows home-bred) and six farms with "flying stocks" (i.e., all cows purchased). We shall confine our attention to these twenty-two farms as being more representative of the milk production industry in general. "Producer-retailers" are in a class by themselves.

Before giving a summary of the results obtained, it should be pointed out (1) that the year was divided into (a) the "summer" or grazing period from 16th May, 1920, to 2nd October, 1920 (20 weeks), and (b) the "winter" or house-feeding period from 3rd October, 1920, to 14th May, 1921 (32 weeks), so that the terms "summer" and "winter" have here a special and definite meaning; (2) that nearly all these twenty-two farmers were all-the-year-round producers; (3) that all the home-grown foods consumed by the cows were charged at market prices so that milk production was made to stand on its own legs; (4) that the cost of keeping the cows during the dry period was apportioned over both the summer and the winter milk, e.g., spring

calvers were depreciated in value between the stocktakings at 16th May and 2nd October, 1920, and appreciated between 2nd October, 1920, and 14th May, 1921; (5) that the results for the summer period were completely tabulated and summarised long before those for the winter period were known, *i.e.*, the results for the two periods were obtained independently; (6) that the determination of the relative profits from the two periods was not one of the immediate objects of the investigation; in fact, this is the first occasion on which the results have been discussed from that standpoint; and (7) that the farms in question are thoroughly typical of the higher-grade farms of this class in Scotland.

The following table summarises the results from the present point of view:—

Item.	Breeding Stocks—16 farms.			Flying Stocks—6 farms.		
	Summer.	Winter.	Year.	Summer.	Winter.	Year.
	d.	d.	d.	d.	d.	d.
Aver. Production Cost per gal. ...	12.62	20.39	17.10	17.43	22.28	20.27
" Delivery " " ...	1.13	1.43	1.30	1.27	1.34	1.32
" Total " " ...	13.75	21.82	18.40	18.70	23.62	21.59
" Price per gal. ...	17.68	27.94	23.59	20.70	30.17	26.28
" Net Profit per gal....	3.93	6.12	5.19	2.00	6.55	4.69
Total Milk Produced—gal. ...	133,553	181,229	314,782	41,793	59,506	101,299
Aver. Weekly Production—gal. ...	6,678	5,663	6,053	2,090	1,860	1,948
Relative Production ...	100	85	—	100	89	—
No. of farms where net profit is higher in winter than in summer						

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From this table it appears (1) that on these farms the average weekly output during the winter period was from 10 to 15 per cent. less than in the summer period; in a few cases it was actually higher in the winter than in the summer period; in others it was as much as 25 per cent. less;* (2) with the breeding stocks the milk produced during the winter period left a net profit of nearly 2½d. per gallon more than that of the summer period, while with the flying stocks the difference was nearly 5d. per gallon in favour of the winter period; and (3) that out of the 22 cases 15 showed a higher net profit per gallon in the winter than in the summer period while 7 showed the opposite result.

It should be further noticed that in the case of the breeding stocks the total cost per gallon was 59 per cent. higher in the winter than in the summer period, while the average price per

* It was also found that, with the sixteen breeding stocks, for every 100 gal. of milk per week produced during the 16 weeks from 3rd October to 25th December, 1920, 127 gal. were produced during the 20 weeks from 16th May to 2nd October, 1920, and 108 gal. from 26th December, 1920, to 14th May, 1921.

gallon was 58 per cent. higher, with the result that the net profit per gallon in the winter exceeded that of the summer period by 56 per cent. In the case of the flying stocks the corresponding figures are 26 per cent., 46 per cent. and 227 per cent., respectively.

Is increased Winter Milk Production Profitable?—It follows from the above that if the average cost per gallon of winter milk production were to fall to a greater extent than that of the summer milk (as indeed has probably happened since 1920-21), and if the same ratio were maintained between the summer and winter period prices, then the advantage of winter milk production would be still greater than is here indicated. In this connection, it may be pointed out that, in the recent agreement between producers' and distributors' organisations in England and Wales for the year ending Michaelmas, 1923, the price obtained by those farmers who maintain as uniform a monthly output as in the case of the above sixteen breeding stocks, will be fully 50 per cent. higher in the winter than in the summer period (as above defined).

These results, then, provide an effective answer to the question: In all-the-year-round production as carried on under existing conditions, does the production of milk during the winter or house-feeding period pay at least as well as summer production? We are bound to say that there seems no reason why it should not, and it may be further stated that a detailed examination of the records of the above farms showed that the milk produced during the months of November to February was at least as profitable per gallon as that produced during March, April and the first half of May.

We have still to answer the question: Would it be likely to pay the farmer, who has been in the habit of producing most of his milk in the late spring and summer months, to arrange to calve more cows in the autumn and fewer in the spring so as to increase the production during November to March and decrease it during April to July, i.e., so as to obtain a more uniform monthly output?

Obviously, no definite answer can be given, for much will depend upon the circumstances already mentioned, but reference may be made to the results from experiments carried out under the auspices of the Irish Department of Agriculture in furtherance of a campaign for increased "winter-dairying"—in 1909, a census of 63 typical Irish creameries showed that

70 per cent. of the annual output was produced from May to September and only 10 per cent. from December to March.*

A Trial in Ireland.—The first series of experiments was conducted at two centres in County Cork during the years 1907-08.† At each centre 5 cows calved in the autumn (November, 1907) and 5 in the spring (March and April, 1908), careful records of feeding, milk yield, quality of milk, etc., being kept for each cow for the complete year after the date of calving. A profit and loss account for each lot was finally drawn up.

At each centre the autumn calvers, chiefly on account of the better yields and higher average prices for the milk, and in spite of the increased cost of feeding, etc., gave a higher net profit than the spring calvers—to the extent of £2 10s. 1d. per head in one case and of £1 4s. 1d. per head in the other. In both cases, the experimenters considered that a clear case for increased winter dairying had been made out. Other experiments in County Cork‡ and also in County Down§ gave substantially the same results.

It is true that in certain respects these experiments are open to criticism, but in the main the results certainly go to show that under suitable conditions an increase of winter dairying in Ireland would be likely to prove highly advantageous.

Similar experiments to the above have not, so far as the writer is aware, been carried out in Great Britain, but in an analysis of the data on the cost of food in the production of milk obtained by Crowther and Ruston in the Yorkshire investigations, Wilson§ arrived at the conclusion "that cows with similar yields produce milk at similar costs, irrespective of their times of calving," for the reason "that the winter-fed cow gives enough extra milk to make up for the extra costs."

Winter Milk Production in Denmark.—In Denmark, as indicated by the data already given, winter milk production is very extensively practised, partly with the object of maintaining a uniform output of butter, etc., all the year round. In that country, the important part which root crops play in successful winter dairying is shown by the fact that the area under mangolds, swedes and turnips has increased from only 95,000 acres in 1888 up to 330,000 acres in 1901 and 678,000 in 1919; in 1918 nearly 10 per cent. of the total acreage of crops

* *Jour. of the Dept. of Agric. and Tech. Instr. for Ireland*, Vol. XII, No. 2.

† *Ibid.*, Vol. IX, No. 4.

‡ *Ibid.*, Vol. XI, No. 1; Vol. X, No. 1.

§ *Ibid.*, Vol. XVII, No. 2, pp. 223-4.

and grass was, under these crops, compared with only a little over 5 per cent. in Great Britain.* It may well be argued that what is possible in Denmark must also be possible in many districts in both England and Scotland.

It is freely recognised that winter milk production cannot be successfully practised under all conditions, and also that a sudden and widespread change of policy on the part of milk producers would probably lead to disastrous results; but in the writer's opinion there is no doubt whatever that a gradual levelling up of the monthly milk output in Great Britain would prove beneficial alike to the producer, the distributor and the consumer. All the evidence available supports this view, and it is probable that experience of the price-agreements above referred to will go far to confirm it. Conditions pertaining to both production and consumption have changed considerably in the last twenty years, but producers have been somewhat slow to modify their methods of production accordingly. It is hoped that this article may serve to direct attention to what is undoubtedly one of the most important aspects of economic milk production.

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GLIMPSES OF AMERICAN HORTICULTURE.

I.

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IMPRESSIONS of interest and of value to cultivators at home should be gained as the result of a visit to the United States of America, especially when it embraces visits to many State Horticultural Stations, as well as to commercial plantations scattered in various States necessitating travelling nearly 4,000 miles. When one proceeds to sort out the impressions gained, however, there is a danger of creating the idea that one feels entitled, after a few weeks of observation of so vast an area, to dogmatise on its characteristics and sum up its features.

The intention is not to dogmatise but to give a few impressions collated from notes taken at the time, in the hope that they may be of interest, or may furnish some useful information. There are circumstances which appear to owe their existence

* *Forage Crops in Denmark*, Harald Faber, pp. 28-29.

to the character of the American people, who seem possessed of a fever, induced by a reaction to the many-voiced call of opportunity and the hustle and haste of a new country with almost limitless potentialities, to exploit the chance of to-day without waiting to consider what will be the effect on to-morrow. This attitude of mind may account for the American neglect of gardens, for hardly any attempt seems to have been made to cultivate the garden such as British people know it. The land attached to villas and cottages in the suburbs remains unfenced with the lawn sloping direct up from the side walk of the road. The lawn, if the spare piece of land covered with weeds can be so described, is curiously enough mown with scrupulous attention. Vegetable gardens are but rarely seen, and where they are it may be taken for granted they are cultivated by Englishmen or Scotchmen. Of flower culture in small gardens there is little or none, yet the American is undoubtedly a flower lover, and is willing to pay high prices to gratify his taste.

In Washington at the end of May gladioli were making 3 and 4 dollars a dozen, single blooms of *Cattleya* were selling for 4 dollars (in January they went up to 6 dollars), and little baskets of mixed flowers such as one could buy for 2s. 6d. or 3s. in England were selling for 3 dollars.

The European allotment does not appear to exist in the States, though there are a few plots at Washington on some land reclaimed by dredging from the River Potomac that might be described as allotments. Washington, a City of 400,000 inhabitants, possesses fewer of these plots than would suffice a country village in England. One could not resist the reflection that if by some disaster, such as a widespread strike, the supplies were cut off, then Washington would be reduced to starvation in a few days, there being no cultivation of fruit or vegetables in or around it. The reasons why the allotment is not a feature of American life as here, were variously stated. The climate was given as one, the winter temperature being too low for ordinary outdoor vegetables and the summer too hot and dry for vegetable production without constant watering. The fact that the twilight is short was given as another reason. These may have had an unfortunate influence, but other factors also seem to have contributed to prevent a spread of the movement. The cheapness and low running cost of the automobile has made it possible for nearly everyone to possess a motor, and the evenings and Sundays are spent in the car, leaving but little time for other pursuits. This

may be a real reason why the villa gardens are but poorly attended and the allotments remain undeveloped.

Haste in cultivation of the commercial plantation is also evident. It is quite common to see large areas where cultivation is carried on amid standing stumps of the forest trees. These stumps stand 3 ft. to 4 ft. out of the ground, and are, of course, irregularly placed as Nature planted them. Any grower will realise what it means to carry on the processes of cultivation among such obstacles; yet many thousands of acres, particularly in Tennessee, Kentucky, Georgia and North and South Carolina are thus cultivated. These large areas, though cultivated by different people, are not divided by hedges, such as is the custom in this country and which makes the lanes of England so picturesque, but are generally left unfenced, except where cattle have to be kept in bounds, when various styles of rapid, inexpensive and generally untidy methods of fencing are resorted to. A unique method was that adopted by a large Dairy Company who constructed an ugly but effective fence by using the stumps of the trees that once covered the land and piling them up side by side. Idle land has no place in the American rotation, for one sees no fallows, unless the land where corn (maize) was gathered last year and is now left with the stalks still standing amid the weeds, can be regarded as a fallow. The practice of forcing wild flowers such as foxglove and cornflower may be due to this haste of exploitation—or perhaps to the policy of the Federal Horticultural Board which, by making the importation of the better types almost impossible, drives people to the common and makes possible fortunes from weeds. Other practices may perhaps be due more to circumstances than to any characteristics of the people. Town manure is very scarce, and the cost of carriage over long distances is prohibitive. This has led to the practice of growing green crops for ploughing in for "soil improvement" on a very much greater scale than in England. A favourite crop for this purpose is a mixture of tares and rye, though many other crops are used. A grower of outdoor cucumbers at Norfolk, Virginia, was using sorghum for this purpose. He said the sorghum when 10 ft. high would be ploughed by the aid of a specially constructed machine into the land.

It may be of interest to record this grower's method for manuring his cucumbers. The variety grown was a white spine, shorter than our greenhouse varieties. The plants were raised in heat in April and planted out in the beginning of May. The

land receives 100 loads of manure per acre, consisting mostly of town manure but containing a mixture of fine tobacco dust bought at 2 dollars a ton, which is put in to serve as an insecticide. Artificial manure containing 7 per cent. of ammonia, 6 per cent. of phosphate, and 5 per cent. of potash is added. The grower also had an ingenious method for supplying liquid manure to his cucumbers. Water was lifted by means of a pump geared to an old Ford car engine from 6 wells into one main from which it issued on to a piece of sacking stretched over a collecting tub. A negro workman, provided with a watch, was stationed by the tub to put 5 lb. of nitrate of soda on to the sacking at intervals of every 5 minutes, the pumps delivering 50 gallons of water every minute. The water containing the nitrate of soda was conveyed to the cucumbers by means of overhead pipes on the "Skinner" system. Such practices serve merely as examples to show the many methods to overcome difficulties in manuring employed by the American.

The climate naturally varies over so wide an area, and the effect is seen in the practices in operation in the different States. In Florida the season of vegetable culture is from November to May. Tomatoes are grown extensively out of doors: one man is said to cultivate 1,000 acres of this crop. They finish by the end of May when the land becomes ready for corn (maize). Here also grape fruit and other citrous fruits form an important crop. Mangoes are just being developed, by breeding, into a popular variety of fruit. Great thought is being given to the methods of transporting the mangoes. The latest device consists of a box divided into three compartments, the two end compartments being lined with the finest type of wood wool, in which the fruit is packed. The centre compartment, provided with holes on both sides of it, contains ice for cooling purposes. The Avocado, or Alligator Pear (although it is not a pear at all), is now being largely cultivated. The fruit is eaten as a vegetable with oil and condiments. Pineapples are grown in large quantities, coconut palms grow wild and ripen their fruit, and sweet potatoes and rice are cultivated.

The extreme variations in climate between summer and winter are experienced at Norfolk, Virginia, where outdoor cucumbers are grown in abundance in summer, but the winter is so cold that glass must be provided to protect the parsley crops.

The effect of these climatic conditions upon the growth of trees is remarkable. The oak grows much more rapidly there. In Washington the Kinko Biloba makes a handsome tree.

When one comes to the north—to Canada—apple trees may burst their bark and even their roots under the effect of severe frost, while vines ripen their fruit out of doors, peaches are grown extensively as half-standards, and maize set out in July ripens its seed before winter sets in.

* * * * *

THE TWELFTH REPORT OF THE DEVELOPMENT COMMISSIONERS.

THE Report of the Development Commissioners for the year ending 31st March, 1922, which has recently been issued by H.M. Stationery Office,* contains an account of the greater part of the agricultural research carried on in the United Kingdom during the year. Owing principally to the general restriction in public expenditure the total advances from the Development Fund were less than for several years past, amounting to £868,450, compared with £636,467 in the previous year. Of the former amount £236,031 went to agriculture and rural industries, including reclamation and drainage of land, and the remainder to harbours and fisheries.

The benefits conferred on agriculturists by the Fund will be realised from the estimate of the Commissioners that the total expenditure of the United Kingdom on agricultural research during the year is unlikely to have exceeded £200,000, of which £172,000 was provided by the Development Fund. This State expenditure has, moreover, not merely taken the place of private expenditure, as the sum spent before the Development Fund was available was less than one-tenth of that of the present day.

Rural Industries.—The subjects to which the Commissioners have given special consideration during the year have been Rural Industries and Animal Diseases. It is pointed out in the report that rural industries flourish in France and Germany while they are derelict in this country. Yet England is not inferior to those countries in natural resources and industrial skill, while it provides a rich and wide market which indeed now absorbs large quantities of the products of foreign rural industries. Moreover, rural industries are the solution of the difficult problem of finding suitable employment for disabled ex-Service men, and it is noteworthy that in France and Germany this problem hardly exists.

The Commissioners therefore framed a scheme for setting up (a) the Rural Industries Intelligence Bureau, which will offer

* To be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, price 3s. 6d. net.

skilled advice to those engaged in or contemplating the establishment of any rural industry, and (b) The Country Industries Co-operative Society, Ltd., for supplying materials and marketing the products.* The former was assisted by a grant of £2,500. The latter, being a trading association, is not aided financially. The Commissioners also made a grant of £4,210 to the Oxford Institute of Agricultural Economics for a detailed examination of existing rural industries in England and Wales. A full and interesting report by Mr. E. C. Kny on industries in rural districts is printed as Appendix II to the Report under notice.

Animal Diseases.—As regards diseases of animals it is pointed out that in human medicine great advances have been made in recent years and there has been an organised attempt to secure the benefits of new knowledge and methods; in veterinary medicine, on the other hand, the effort has been slight. Yet every farmer is aware of the annual losses which disease causes him, and the cost to the public has been forcibly demonstrated by the heavy bill of costs incurred in combating the outbreak of foot-and-mouth disease in the past year. The Commissioners accordingly appointed an Advisory Committee in 1921 to inquire into the subject, and a programme is now being prepared to give effect to the recommendations of the Committee. A substantial sum out of the funds allocated to the Development Commission under the Corn Production Acts (Repeal) Act, 1921, has provisionally been reserved to give effect to the scheme. The chapter on the subject contained in this report should be widely read in order that both agriculturists and the general public may support the Commissioners in putting an end to a state of affairs which the Report describes as a national disgrace.

Agricultural Research and Education.—The following grants to the Ministry of Agriculture and Fisheries were recommended by the Commissioners for the continuance of the agricultural research scheme and for the development of agricultural education.

Grants to institutions in aid of :—		£
(a) Scientific research and experiments (maintenance grants)	...	78,000
(b) Extension of advisory work ... ..	...	21,000
(c) Special investigations ... ..	...	4,000
Research scholarships and travelling research fellowships	...	2,000
Administration expenses ... ..	...	1,200
		£106,200
Less amount not payable from the Development Fund	...	1,150
		£105,050

* See this *Journal*, Vol. XXIX, pp. 348 and 349.

The following grants to the Ministry were also recommended:—

Grant to meet the deficit on the working of the Cattle Testing Station during the year 1921-22	£ 1,094
Agricultural machinery experiments: Year 1921-22	5,650
University College, Reading: Grant towards cost of stocking the farm in connection with the Research Institute in Dairying	2,500
Alterations and additions to the Ministry's vegetable drying and fruit preserving factory at Chipping Campden (additional factory grants)	1,250
Demonstration Lactose Factory*: Further capital expenditure and cost of maintenance up to 31st March, 1923	7,450
Cost of an inquiry into a Superannuation Scheme for certain agricultural institutions	250
Maintenance of a Willow Experimental Station: Year 1922-23	800
Maintenance of National Institute of Agricultural Botany: Year 1921-22	2,450
Ditto: Year 1922-23	3,000
Demonstrations in intensive milk production on arable land. Net expenditure during the year 1921-22	1,500
Ditto: Year 1922-23	2,300
Experiments in the cultivation and rehandling of tobacco: Capital expenditure and costs of experimental work during the four years from 1919-20 to 1922-23	2,000

Agricultural Machinery Experiments.—The grant of £5,650 was made to cover the salary and expenses of an engineer, experimental work on drainage machinery, potato diggers, tractor harvesting machinery, hedge-cutting machinery, turnip thinning and harvesting machinery, and minor experimental work. The results of this work are in course of publication in a series of reports,[†] and articles summarising the results are appearing in this *Journal*.[‡]

Milk Production on Arable Land.—The large scheme of demonstration holdings originally proposed has had to be cut down on account of the financial situation, but three holdings have been retained for the purpose of demonstrating the possibility of providing a large production of milk by arable cultivation, and securing information by experiments which farmers cannot risk making, as to the best rotations and systems of farming for the purpose.

Willow Experimental Station.—On the recommendation of an Advisory Committee appointed by the Ministry the Develop-

* See this *Journal*, Dec. 1922, p. 774.

† Hedge and Stump Clearing Devices: Misc. Pubn. No. 35. Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1, price 2s. 6d.

‡ This *Journal*, April, 1922, p. 6; July, 1922, p. 369; January, 1923, pp. 880 and 911.

ment Commissioners recommended a grant for investigations to be carried out in connection with the Long Ashton Agricultural and Horticultural Research Station, Bristol, with the object of extending the production of osiers, and providing advice for willow growers and basket makers on questions of organisation, marketing, and machinery, in order that foreign competition in the basket-making industry may be successfully faced.

An account is also given in the report of a number of investigations into special agricultural problems which were financed by the Commissioners. Work in Scotland and Ireland is also dealt with.

* * * * *

SUB-SOILING.

PRELIMINARY REPORT OF A TRIAL OF SUB-SOILING DEVICES HELD AT HIGH HILDON, TONBRIDGE, IN OCTOBER, 1922.

Introductory.—In many soils there exists below the top soil a solid stratum which may vary in thickness from 4 in. to 10 in., formed either by chemical action or by the mechanical action of continuous cultivation, particularly ploughing, carried on year after year at the same depth. This hard "pan" has certain obviously bad effects. It does not allow of the free passage of water and air and generally impairs the fertility of the soil.

The practice of disturbing the hard pan, usually called sub-soiling, has been practised for at least a century, but the records of experiments which have been published clearly show that sufficient care was not exercised in determining exactly what the process was which produced favourable results, and why failure attended subsequent attempts to repeat these experiments. It appears, however, that some experimenters at least ploughed deep (*i.e.*, inverted the soil) when they believed themselves to be sub-soiling, and brought to the surface soil which required a long time to weather before it became fertile. But these distinctions were not at the time appreciated; and consequently sub-soiling was condemned when condemnation should probably have been found in deep ploughing unsuitable soil. From time to time, however, the practice has been revived and in some districts appears to have been followed continuously for a long period; but it is at present impossible, in the absence of carefully recorded experiments, to indicate the limits within which

sub-soiling is beneficial. The factors are many and an extensive scheme is required to determine all the underlying principles involved. It is not only a question of using a suitable machine in the right way, but also of determining what effect sub-soiling has upon the yield and quality of future crops. Some scientific experiments have already been carried out abroad but have not yielded much more than negative results, and the Ministry has decided therefore to institute investigations for the purpose of ascertaining the cost of sub-soiling and its results on various types of land.

Method of collecting Data.—Typical soils have been chosen in different parts of the country so that as many conditions as possible which may influence the results may be included, and the investigations will extend over a period of at least five years. The data will be collected under two heads :—

(1) The cost of performing the operation by various methods will be determined : mechanical data relating to the efficiency of the various machines will also be obtained.

(2) Data will be collected as to moisture content, soil temperature, chemical and mechanical changes, and the resultant yield and quality of the crops.

It will be at least a year before information will be available under the second heading, and so far, the data available relate only to the cost of sub-soiling by each method employed and the mechanical effect of each implement in disrupting and disturbing the hard "pan."

Test and Demonstration at High Hilden, Tonbridge.—It is proposed here to present the results of a test of seven sub-soiling devices organised by the Ministry, acting in conjunction with the Kent Agricultural Education Committee and the local Branch of the National Farmers' Union, and held at High Hilden, Tonbridge, in October, 1922, by the courtesy of Mr. F. O. Streeten. The field upon which the tests were held was stubble land with a gentle slope downwards from the south-western end, the soil being medium loam ranging from about 7 in. deep at the top end to 10 in. at the bottom, over a clay sub-soil. Plots of equal area were marked out and allotted to the various machines, and a control plot was provided for ploughing only.

Tests were made for the purpose of ascertaining as far as possible the economic and mechanical efficiency of the sub-soiling devices. On the first day a capacity and consumption test was made. Each device was run for a definite time and measurements were taken of the area ploughed and sub-soiled, the average dimensions of work done, and the consumption of

fuel. Records were taken by a Watson dynamometer of the pulls registered by each device when ploughing only and when both ploughing and sub-soiling. The difference between the two results shows the increase of load due to sub-soiling. One observer was allotted to each machine and from the records taken the final results have been compiled. Every precaution was taken to ensure accuracy. The ploughmen were instructed to plough at a uniform depth of 7 in. and to sub-soil a further 5 in. and measurements were taken at regular intervals for each machine.

Observations on the Performance of each Device and Summary of Results.

(1) *Ransomes' Self-lift Tractor Plough (R.S.L.S., T.C.P.)* with solid coulter, skim coulter and sub-soil tine. Manufactured by Messrs. Ransomes, Sims & Jefferies, Ltd., Ipswich. Price £34 1s. 6d. Tractor: British Wallis, 25 H.P. Price £300.

Width of furrow in inches	...	...	...	...	10
Depth of ploughing in inches	...	...	...	...	7.5
Extra depth sub-soiled in inches	...	...	...	...	5.5
Drawbar load in lb. when ploughing	...	...	...	...	816
Drawbar load in lb. when ploughing and sub-soiling	...	...	...	...	1,391
Acreage ploughed and sub-soiled per day	...	...	...	...	1.3
Cost of ploughing and sub-soiling per acre	...	...	...	...	24s. 2½d.

The sub-soiling tine on this single-breasted plough is attached at the rear and works in the newly made furrow bottom immediately behind the breast. Facilities are provided for rapidly adjusting the depth at which the tine works. The draw bar load registered by the Watson dynamometer was not very steady when sub-soiling, but was very regular when ploughing only. The work done by this plough was very good, the furrows being very regular.

(2) *Ransomes' 2-Furrow Self-lift Tractor Plough (R.S.L.D.-X.L.)* Kent breast with sub-soil tine. Price of plough £37 8s. 6d., sub-soil attachment £4 extra. Tractor: Weeks-Dungeo. Price £350.

Width of furrow in inches	...	...	...	...	10.5
Depth of ploughing in inches	...	...	...	...	7.25
Extra depth of sub-soiling in inches	...	...	...	...	5
Drawbar load in lb. when ploughing	...	...	...	...	825
Drawbar load in lb. when ploughing and sub-soiling	...	...	...	...	1,133
Acreage ploughed and sub-soiled per day	...	...	...	...	1.73
Cost of ploughing and sub-soiling per acre	...	...	...	...	17s. 6¾d.

The sub-soiling tine with this plough is mounted in the position usually occupied by the front breast. This implement ploughed and sub-soiled a greater area than Ransomes' deep digger and also registered a lower average draught, and did excellent work.

(3) *Ruston and Hornsby's Single-Furrow Self-lift Deep Digger*—Price of plough £31 10s., with sub-soil tine £33 5s. Manufactured by Messrs. Ruston Hornsby, Ltd., Grantham. Tractor: British Wallis.

Width of furrow in inches	...	...	...	...	14
Depth of ploughing in inches	...	...	...	...	7.9
Extra depth of sub-soiling in inches	...	...	...	...	5
Drawbar load in lb. when ploughing	...	...	...	...	925
Drawbar load in lb. when ploughing and sub-soiling	...	...	...	...	1,125
Acreage ploughed and sub-soiled per day	...	...	...	...	2.75
Cost of ploughing and sub-soiling per acre	...	...	...	...	12s. 5½d.

The sub-soiling tine on this plough follows immediately behind the breast and so sub-soils under the newly made furrow bottom. A very regular draught was registered. In the capacity test, a considerably larger area was ploughed than by any other machine, but it must be observed that good work was to some extent sacrificed for speed. This plough turned the largest furrow of any machine under test.

(4) *Ruston and Hornsby's 2-Furrow Self-lift General Purpose Plough*.—Price £35 10s. Tractor: British Wallis.

Width of furrow in inches	...	...	...	...	10
Depth of ploughing in inches	...	...	...	...	7.23
Extra depth of sub-soiling in inches	...	...	...	...	5.83
Drawbar load in lb. when ploughing	...	...	...	...	704
Drawbar load in lb. when ploughing and sub-soiling	...	...	...	...	1,160
Acreage ploughed and sub-soiled per day	...	...	...	...	2.07
Cost of ploughing and sub-soiling per acre	...	...	...	...	16s. 0½d.

The sub-soiling tine on this plough is fitted in place of the front breast and so runs under the furrow bottom made previously. With the exception of the Ruston and Hornsby deep digger, this plough covered a greater area than any other plough, though here again the work done was not quite of the same quality as that done by other ploughs at less speed. The draught of this plough was noticeably light, but the extra load due to sub-soiling increased the total draught considerably owing to the sub-soiling tine being set at a greater depth than any other.

(5) *Celliers Sub-soil Attachment*.—Manufactured by Celliers Motors Ltd., Brighton Road, Coulsdon, Surrey. Price £12 12s. Sellar's plough. Tractor: Fordson. Price £120.

Width of furrow in inches	...	...	...	...	10
Depth of ploughing in inches	...	...	...	...	7.4
Extra depth of sub-soiling in inches	...	...	...	...	5
Drawbar load in lb. when ploughing	...	...	...	...	1,003
Drawbar load in lb. when sub-soiling	...	...	...	...	453
Acreage ploughed and sub-soiled per day	...	...	...	...	1.63
Cost of ploughing and sub-soiling per acre	...	...	...	...	16s. 8d.

In this case the sub-soiling attachment does not form part of the plough, but is attached to the rear of the tractor, the sub-soiling tine being immediately behind the right hand driving wheel. A screw and handle is provided to regulate the depth of working, and it is necessary to raise the sub-soiling tine when travelling round headlands. This unit performed very good work, but it would be an advantage to have marked on the adjusting screws the tine depth in relation to the plough depth. Some ready means of raising the tine when travelling on the headlands should also be devised.

(6) *Darby Sub-soiling Conversion Set*.—Manufactured by S. C. Darby, Wickford, Essex. Attached to an International tractor plough. Price of attachment £7 15s. Tractor: International Junior. Price £250.

Width of furrow in inches	...	...	...	...	10.5
Depth of ploughing in inches	...	...	...	...	7.4
Extra depth of sub-soiling in inches	...	...	...	...	5.1
Drawbar load in lb. when ploughing	...	...	...	...	799
Drawbar load in lb. when ploughing and sub-soiling	...	...	...	...	1,200
Acreage ploughed and sub-soiled per day	...	...	...	...	1.23
Cost of ploughing and sub-soiling per acre	...	...	...	...	25s. 6d.

The Darby conversion set can be attached to any plough, but during tests it was used with an International tractor plough, the front breast being removed for this purpose.

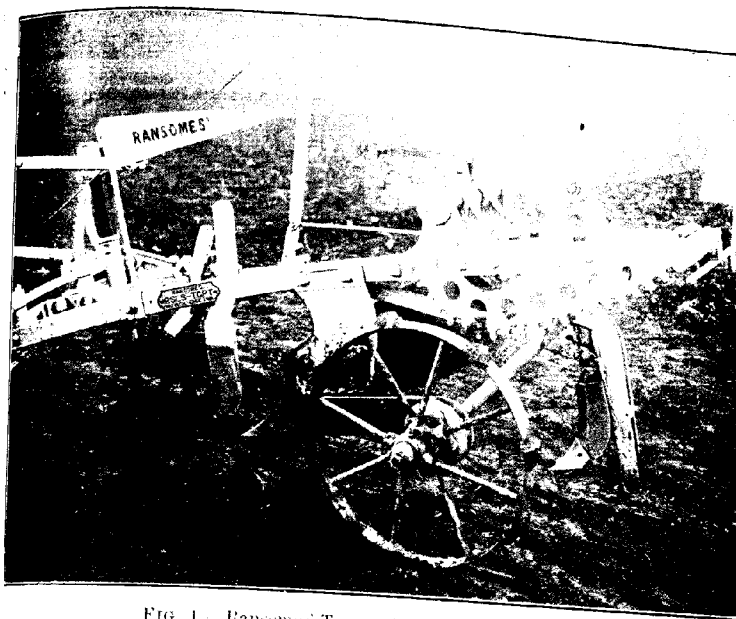


FIG. 1. Ransomes' Tractor Plough and Sub-Soiler.

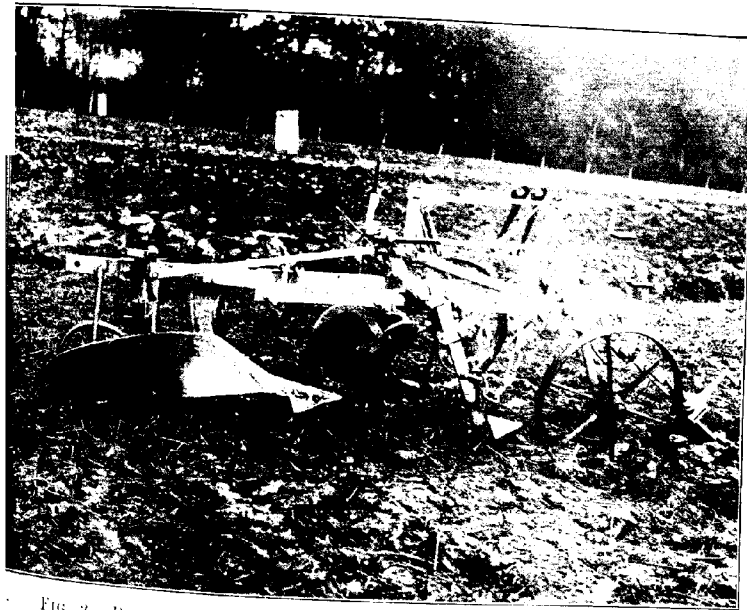


Fig. 2. Ruston & Hornsby's Tractor Plough with Sub-Soiling attachment.

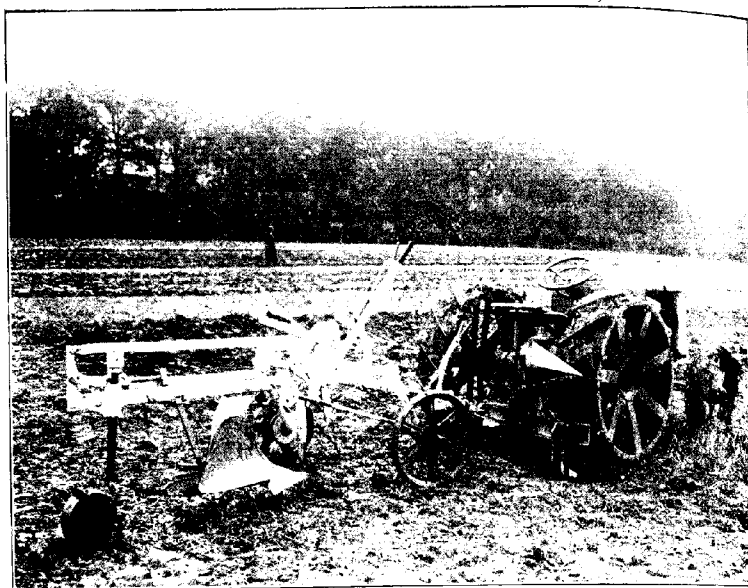


FIG. 3. Celliers' Sub-Soiler for attachment to Tractor.

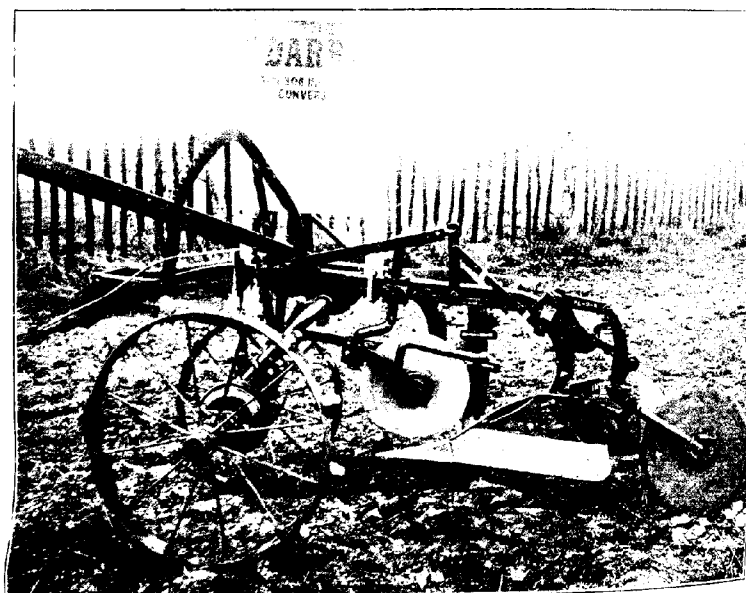


FIG. 4. Darby Sub-Soiling Conversion Set.

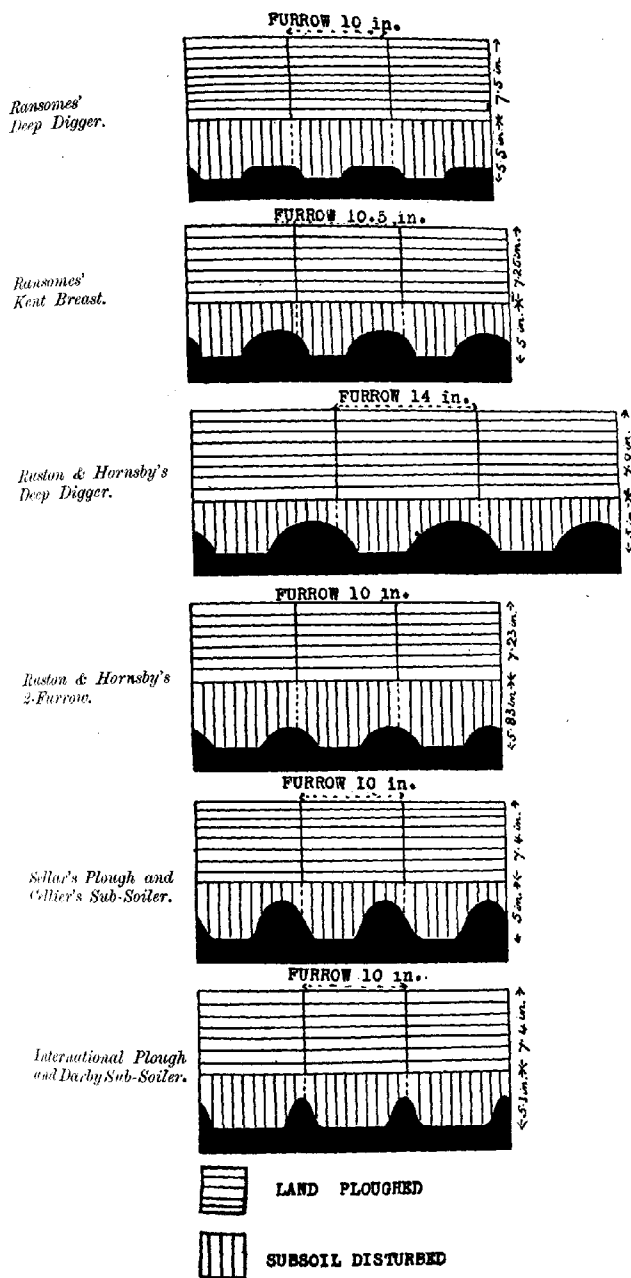


FIG. 5.—Sectional view of Land Ploughed and Sub-Soiled.

(7) *Ransomes' XL Horse Plough, fitted with Sub-soil Attachment* —
Manufactured by Messrs. Ransomes, Sims & Jefferies, Ltd. Price £14 14s.
complete.

Width of furrow in inches	9.5
Depth of ploughing in inches	6.9
Extra depth of sub-soiling in inches	5
Drawbar load in lb. when ploughing	190
Drawbar load in lb. when ploughing and sub-soiling	822
Acreage ploughed and sub-soiled per day	1.93
Cost of ploughing and sub-soiling per acre	25s. 3d.

Three horses were used to pull this sub-soiling plough. The tests were carried out in the early part of the day when the horses were fresh and the ploughmen urged them to do their utmost, and the acreage shown per day is considered to be in excess of the area that a team would do during an average working day. The quality of the work done was very high.

The control plot was ploughed by the Ruston and Hornsby 2-furrow plough at a depth of 7 inches.

Conclusion.—The figures in Table II relating to the quality and quantity of disruption are useful in showing weaknesses in the design of some of the machines. A low disruption of the soil, and a heavy drawbar load indicates that there is some radical modification needed in the design of the tine. For ideal tine action, quality and quantity of the disturbance of the sub-soil should be good and the drawbar load reasonably low.

Whether the sub-soil should be brought to the surface is a matter easily determined when working in clay, where the action is known to be harmful, but in some soils it would be a matter of conjecture and could only be determined by experiment. It may therefore be necessary to employ differently shaped tines for different soils. At Tonbridge the sub-soiling devices were required to disturb the pan without actually inverting it and each machine satisfied this condition. With the exception of the Darby, which is in the form of a straight breast, every sub-soil attachment resembled a cultivator tine in shape.

After the land had been ploughed and sub-soiled, portions of the soil were cut away in each plot in order to ascertain the effect. It was discovered that the sub-soiling tine does not disturb a width equal to the width of the furrow slice. The sub-soil, when regarded in section, presented a series of small ridges, the dimensions of which varied for each machine. In places the Darby sub-soiling tine cuts an almost circular drain, resembling that made by a mole plough. It was decided to observe the effect of deep sub-soiling, and for this purpose Ransomes' deep digger plough was used, ploughing 8 in. deep

TABLE I.
ESTIMATED RESULTS FOR A WORKING DAY OF EIGHT HOURS.
Climatic conditions : Dry and Cold.

Climatic conditions : Dry and Cold.																				
Plough and Sub-soiling attachment	Power	Average dimensions of work done.			Average speed of ploughing and sub-soiling in miles per hour	Total acreage ploughed and sub-soiled	Average speed during dynamometer tests in miles per hour	Average drawbar loads registered				Estimated Cost per acre (including capital charges)								
		Ploughing	Sub-soiling	Depth				Ploughing	Sub-soiling	Reading	Reading		Reading	Reading						
												Width			Depth	Depth	1	2	1	2
Ransomes' Deep Digger	British Wallis Tractor	In. 10	In. 7.5	In. 5.5	1.61	1.3	2.21	lbs. 771	lb. 862	lb. 1,424	lb. 1,358	s. d. 24 2½								
Ransomes' Kent Breast	Weeks-Dungray Tractor	10.5	7.25	5	2.04	1.73	1.47	819	831	1,130	1,135	17 6½								
Ruston & Hornsby's Deep Digger	British Wallis Tractor	14	7.9	5	2.43	2.75	1.10	943	907	1,102	1,128	12 5½								
Ruston & Hornsby's 2-furrow.	British Wallis Tractor	10	7.23	5.83	2.56	2.07	1.87	683	725	1,144	1,176	16 0¼								
Sellar's Plough, Celliers' Sub-soiler	Fordson Tractor	10	7.4	5	2.19	1.68	1.36	1,023	983	* 453	* 453	16 8								
International Plough, Darby sub-soiler	International Junior Tractor	10	7.4	5.1	1.58	1.28	1.79	854	744	1,279	960	25 6								
Ransomes' Horse Plough	3 horses	9.5	6.9	5	2.53	1.93	1.10	468	512	849	795	25 3								

Plough and sub-soil attachment	Power	Average speed during dynamometer test	Average traction loads			Average loads per sq. in. cross section of furrow			Weight per c. ft. of material		Estimated percentage of effective dissection of pan below ploughed section
			Ploughing	Ploughing and sub-soiling	Per cent. increase in load due to sub-soiling	Ploughing	Ploughing and sub-soiling	Sub-soiling	Before ploughing and sub-soiling.	After ploughing and sub-soiling less amount not disturbed	
Ransomes' Deep Digger	British Tractor	Miles per hour 2.21	lb. 816	lb. 1,391	70.5	lb. 10.88	lb. 11.27	lb. 11.88	lb. 107	lb. 99.5	88
Ransomes' Kent Breast	Weeks-Duncey Tractor	1.47	825	1,133	37.3	10.84	9.77	8.1	107	95	76
Ruston and Hornsby's Deep Digger	British Tractor	1.10	925	1,125	21.6	8.36	7.17	4.33	107	90	66
Ruston and Hornsby's 2-furrow	British Tractor	1.87	704	1,160	65.1	9.71	9.62	9.2	107	99	85
Sellar's Plough, Celliers' sub-soiler	Fordson Tractor	1.86	1,003	* 453	---	13.55	---	13.5	107	90	67.
International Plough, Darby sub-soiler	International Junior Tractor	1.79	799	1,200	50.2	10.8	10.18	9.14	107	100.5	86
Ransomes' Horse Plough	3 Horses	1.10	490	822	67.8	7.18	---	---	107	85	---

* Pull due to sub-soiling alone.

and sub-soiling a further 10 in. It was discovered that when working at this depth, the tine formed a drain resembling that made by the Darby, though the width of the tine standard caused a greater gap for the whole depth of the sub-soil. The sub-soil all round was well disturbed.

The tests at Tonbridge proved conclusively that the sub-soiling devices actually broke up the hard pan and disturbed the sub-soil without bringing any to the surface. Whether the correct type of sub-soiling tine has been evolved it is too early yet to say. The strakes on tractor wheels running in the furrow, assisted materially in breaking the hard pan and so decreased the load necessary to pull the sub-soiling tine.

Explanatory Notes to Tables.

Table I.—Results for a working day of eight hours.—Approximately one hour was allotted to each machine for its capacity test, but as only a fraction of an acre was ploughed and sub-soiled during the test the working time has been expanded so as to represent eight hours, and the results calculated accordingly for convenient comparison.

Average dimensions of work done.—The dimensions of work done were ascertained at intervals of 10 yards for all machines.

Average Speeds.—The dynamometer test was distinct from the capacity test, and the pulls recorded are those obtained during the dynamometer tests only. As a great divergence of speed occurred, the drawbar pulls are not strictly comparative, and it is probable that if records had been taken of the Ransomes' Deep Digger and the Ruston and Hornsby Deep Digger for instance when ploughing and sub-soiling, at the same speed, the results might have been appreciably different.

Average drawbar loads registered.—The drawbar loads were registered by means of a Watson dynamometer for tractor-drawn ploughs, and by a Salter dynamometer for the horse plough. The speed at which these results were obtained must be kept in view when studying the figures. The Celliers sub-soiling attachment was fitted to the tractor and not to the plough. A British Wallis tractor was therefore used to pull the Fordson both with and without the sub-soiling attachment in operation. The difference of pull recorded in this manner represents the pull due to sub-soiling alone, under the conditions of the test.

Estimated costs.—The actual fuel consumed by the tractors during the capacity tests was measured and the cost calculated, and to this main cost has been added the cost of labour and capital charges. Several types of tractors were used to draw the ploughs, and varied in price from £120 for the Fordson to £350 for the Weeks-Dungeo. The capital charges for the latter tractor are therefore almost treble the former. This naturally increased the working costs of the ploughs drawn by the more expensive tractors, though the capital charges in themselves were not very large. A further point must be remembered, namely, that different types of tractors consume different quantities of fuel for similar work. The costs given apply only to each machine working under the conditions stated and drawn by the tractor named, and to this extent they cannot be regarded as strictly comparative.

Table II.—Increased loads due to sub-soiling and percentage disruption of sub-soils.—The first four columns do not require any explanation.

Average Loads per square inch cross section of Furrow.—From the diagrams, Fig. 5, it will be seen that the sectional area of sub-soil disturbed varied for each device. The average loads per square inch section have been calculated from the dimensions of work done and the pull absorbed at a definite speed.

Disruption of Sub-soil.—The volume of sub-soil disturbed by a sub-soiling tine depends upon the nature of sub-soil, the formation of sub-soil tine, and its speed of travel.

The degree of disintegration of sub-soil did not vary greatly for each device, the net result being that after ploughing and sub-soiling, the furrow slice was inverted and had the normal air space underneath, but beneath the usual furrow bottom was a volume of loose sub-soil containing air and permitting the roots of plants to enter.

To obtain information about the actual effect of sub-soiling, a cubic foot of earth was weighed before and after being ploughed and sub-soiled. The difference between these two weights under given conditions is a measure of the disintegration that takes place.

* * * * *

COUNCIL OF AGRICULTURE FOR ENGLAND.

The Ninth Meeting of the Council of Agriculture for England was held on 7th December, 1922, at the Middlesex Guildhall, Westminster. The Chair was taken by Sir Douglas Newton, K.B.E., M.P.

Appointments to the Agricultural Advisory Committee for England and Wales.—At separate meetings of Minister's Members, and County and Borough Agricultural Committees' Members held previously to the full Council Meeting, the following Members of the Agricultural Advisory Committee, retiring under Regulation 8, of the Agricultural Councils and Advisory Committee Regulations, 1920, were reappointed for a further period of four years:—

Minister's Members.—Lord Clinton, representing owners of agricultural land; Mr. George Edwards, representing agricultural workers; Lady Mabel Smith, representing women.

County and Borough Agricultural Committee's Members.—The Right Hon. Lord Ailwyn of Honingham, Mr. E. W. Langford, and Mr. G. G. Rea.

Statement by the Minister.—The Minister of Agriculture made a statement dealing with certain matters of importance arising at the present time. He informed the Council of the position in regard to the Importation of Animals Bill now before Parliament, embodying the agreement which had been come to between the Home Government, in the time of his predecessor, and the Dominion of Canada. The conditions placed on the importation of animals under the Bill were the minimum safeguards necessary to protect the live stock of this country. The Bill was being taken in a very short time

at the urgent request of the Canadian Government, who wished to see the matter settled at the earliest possible moment.

The Minister also informed the Council that he proposed to set up a Departmental Committee to deal with the question of the disparity between wholesale and retail prices of agricultural commodities. The full terms of reference to this Committee were to inquire into the methods and costs of selling and distributing agricultural, horticultural, and dairy produce in Great Britain, and to consider whether, and if so by what means, the disparity between the price received by the producer and that paid by the consumer can be diminished. Complaints on this subject had been very manifest to anyone engaged in the recent General Election. He was hopeful that he would be able to announce the names of the Members of the Committee in the course of a few days.

The question of the extension of credit facilities to those engaged in agriculture was one which was already being carefully examined by a Cabinet Committee under Sir Theodore Chambers. A Report would probably be issued by it before Christmas, and he trusted that some practical Scheme which would give real assistance to the farmers in need might be evolved.

With regard to the incidence of rates in agricultural districts, the Minister stated that the subject had already been before the new Government, and that he was authorised to say that every effort was being made to find a satisfactory and early solution of the problem, and that it was hoped to make proposals when Parliament met again in the New Year.

On the question of the drainage of agricultural land, this was being dealt with in connection with unemployment relief, and was one of the most useful directions in which the work of unemployed persons could be utilised. A considerable amount of money had been expended last winter on relief drainage works. This year the Government had decided to allocate some £450,000 for the purpose, and the work under this scheme was to be completed by the 31st May next. Already over 200 schemes had been sanctioned and a large number of them were already in operation.

At the last Meeting of the Council the extensive outbreak of Foot-and-Mouth Disease which commenced last January was still raging. The Minister was happy to say that by the 30th June the outbreak had been brought to its last reported

case, and the country was declared free from disease following upon that outbreak about a month ago. Further cases had, however, occurred recently in other parts of England, though the new outbreak was not serious. He hoped that with the measures now being taken to control the spread of the disease, the Ministry would soon be able to declare the country once more free of it. The Departmental Committee, under the Chairmanship of Capt. Pretyma, M.P., which was inquiring into the origin and circumstances of the recent large outbreak of Foot-and-Mouth Disease, and into the policy and procedure that were followed in dealing with outbreaks at the present time, were holding their final meeting that day and he hoped that Report would be presented very shortly.

The grant in aid of agricultural development made under the Corn Production Acts (Repeal) Act, 1921 (the share of which for England and Wales amounted to £850,000), was being allocated in accordance with the agreement which had been reached that the sum should be expended during the period of five years ending 31st March, 1927, and should be additional to the sums which were formerly being spent by the Government on agricultural education and research. Some of the new schemes started out of the money would involve a continuing charge for maintenance after 1927, though it would be the duty of the Ministry to reduce such continuing charges to an absolute minimum.

In reply to questions, the Minister stated that the advisability of a test against abortion in the case of cattle imported for breeding purposes would be considered by the Ministry in framing any Order permitting such cattle to be imported. Representation for labour would be provided on the proposed Committee on Prices, and the Minister would consider whether it was possible to extend the terms of reference of the Committee to cover the question of the importation of flour. It was also stated that a Bill would be introduced before long to assist in the reduction of Sheep Scab on the lines indicated in the Report now being laid before the Council of the Proceedings of the Agricultural Advisory Committee.

Lord Selborne moved and Mr. A. W. Ashby seconded a motion that a hearty vote of thanks be accorded to the Minister of Agriculture for his statement. In the course of his speech Lord Selborne said that the Minister had entered on his great post at a moment of consummate tragedy in the history of the English countryside—far more, in his judgment, than that

of 40 years ago. He referred to the impoverished condition of landowners, and the outstanding facts of recent agricultural history. He thought the present position was due in some measure to the selfishness and ignorance of the urban population. Mr. A. W. Ashby, in seconding the vote of thanks, said that he regretted this statement by Lord Selborne, and gave his reasons.

Grading and Packing Apples.—Mr. R. R. Robbins, in the absence of Mr. H. German, moved the following resolution:—

“That the Ministry of Agriculture be requested to arrange, with the assistance of the Development Commissioners, for the establishment of a ‘Packing Station,’ working on co-operative principles, for the grading and packing of apples, to commence work next season. The Station should be fully equipped with the latest proved machinery and fittings for the purpose.”

In doing so, he stated that, had he not been asked to move the resolution, he would have suggested that it was wiser to defer consideration of it until the subject had been fully considered by the organisations. Mr. R. C. Grey seconded the motion, provided that it carried with it the suggestion that the question should be deferred. The Rt. Hon. F. D. Acland put the definite proposition to the Meeting that the motion should be postponed, his reason being that it was part of a much larger question which could usefully come before the Council later on when the time was ripe for the Government to assist, not in the direct financing of such schemes, but in the financing of the organisation and development of co-operative societies for the sale of produce. Mr. H. Padwick seconded this proposal, and the question was postponed, by leave of the Council.

Prices of Wheat, Flour and Bread.—Lord Bledisloe intimated that in view of the statement by the Minister he proposed, with the leave of the Council, to withdraw his proposed motion:—

“That the Council be informed whether any, and if any, what steps are being taken by His Majesty’s Government to ensure that there be some direct relation between current prices of wheat, flour, milling offals and bread.”

Land Settlement.—In the absence of Mr. Denton Woodhead, Mr. Dallas moved:—

“That this Council recommends the Minister of Agriculture at once to institute careful enquiries into the progress which is being made by ex-Service men who have been installed on the land under the Land Settlement Act, 1916.”

Mr. George Nicholls seconded the motion, stating that unless something were done very quickly to reduce the rents of many of the ex-Service men and to assist them with credit facilities.

their position would be one of very great difficulty. He added that the question was one which should be thoroughly thrashed out by the Council, and he would like to see inquiry made and the Council furnished with particulars of the results. The motion was put to the meeting and carried.

Local Taxation and Rates on Agricultural Land.—Mr. James Hamilton proposed, in view of the statement made by the Minister, to withdraw the motion standing in his name:—

"That this Council respectfully urges the Government that, at the earliest possible date, the whole incidence of local taxation as affecting agricultural land be revised; that rates on agricultural land be only levied in proportion to the benefit which it derives from the services provided thereby; and that a larger contribution be made from National Funds towards local rates in respect of National Services and especially with regard to main roads."

His proposal was seconded, and, by leave of the Council, the motion was withdrawn.

Grant to Heavy Horse Societies.—Mr. Colin Campbell moved:—

"That this Council regrets the action of the Ministry of Agriculture and Fisheries in withdrawing the grant to Heavy Horse Societies. Further, in view of the fact that the small amount of money expended conferred great benefit on the production of heavy horses, it strongly urges the Ministry to restore the grant for the 1923 season."

Mr. Campbell added that it was only about £3,000 that was required. Mr. Griffin seconded the resolution, and hoped that the Ministry would not only renew the grant but give a larger sum. The position was discussed at length by the Council and in the course of it, Sir Daniel Hall stated that the Ministry had been compelled to withdraw the grant on the grounds of economy. It was a recommendation of the Committee on National Expenditure that the Live Stock Improvement Schemes should be cut down to the extent of two-thirds. It was the fact that the other Improvement of Live Stock Schemes, such as Milk Recording and the Use of Better Bulls were considered relatively of greater importance than the Heavy Horse Societies' Scheme. A considerable number of these Societies had been established and had proved very successful in their working. The Societies were, generally speaking, now standing on their own legs and doing very good work. After all, the Scheme was primarily an educational one and did not have the object of providing better sires permanently. The circumstances had also been largely altered by the passing of the Horse Breeding Act of 1918, removing unsound stallions. The motion was, later, put to the Meeting and carried.

Credit Facilities.—Mrs. Hugh Middleton moved the following resolution:—

"That this Council respectfully requests His Majesty's Government to provide means by which farmers who have bought their farms and are short of capital can borrow money at a low rate of interest, to enable them, when necessary, to improve their buildings and drain their land."

The mover considered that the passing of such a resolution by the Council ought to strengthen the hands of the Government. Immediate action was necessary if hard cases were to be dealt with before they became disasters. State funds should replace mortgages at the lowest possible commercial rate of interest. Mr. G. G. Rea seconded the motion. Mr. Clement Smith proposed that the words "drain their" should be omitted from the last line of the resolution. This motion was seconded, but on the suggestion of Lt.-Col. Courthope, M.P., the mover and seconder of the original resolution and of the amendment, agreed to a resolution running as follows:—

"That this Council respectfully requests His Majesty's Government to provide means by which farmers can borrow money at a low rate of interest." This amended motion was put to the Meeting and carried.

Report of the Agricultural Advisory Committee.—Mr. G. G. Rea moved that the Half-Yearly Report (No. 4) to the Councils of Agriculture for England and Wales of the Proceedings of the Agricultural Advisory Committee be received by the Council. Lord Bledisloe drew attention to paragraph 6 of the Report, in which the statement was made that the Agricultural Advisory Committee did not consider that the provision requiring the Ministry to give consent in each case before Local Authorities took legal proceedings under the Fertilisers and Feeding Stuffs Act, 1906, should be abolished. He said that he did not agree with that recommendation and thought the requirement should be abolished. He hoped the Council would support his view.

The Council decided that the Half-Yearly Report should be received, subject to the attention of the Agricultural Advisory Committee being drawn to the matter referred to by Lord Bledisloe with a view to further consideration being given to it.

* * * * *

AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

The following is the half-yearly report (No. 4) to the Councils of Agriculture for England and Wales, on the proceedings of the Agricultural Advisory Committee :—

The Agricultural Advisory Committee has had five meetings since the 18th May last, when the last half-yearly report was presented.* The subjects to which the Committee gave the attention which is outlined in this report were as follows :—

(1) **The Milk and Dairies Bill.**—The proposed provisions of this Bill, which had been promoted by the Ministry of Health, were submitted at an early stage for consideration by the Committee. The Committee concurred generally in the objects of the Bill, but considered that the proposals for dealing with tuberculosis of the udder were unsatisfactory and would be better omitted unless they could be made fully practicable and compensation provided as under the Tuberculosis Order in respect of cows eliminated from dairy herds on account of tuberculosis of the udder. They did not approve, also, of a proposed clause in regard to branding of animals so affected. The Minister undertook to bring their advice before the Minister of Health.

(2) **The Grant of £850,000 for Agricultural Education and Research.**—It was pointed out that in accordance with the understanding which had been agreed upon with the Committee, the further allocation of money for Farm Institutes was to be suspended pending a decision as to the proposed Grant for Research into Animal Diseases. The Ministry was being pressed to sanction progress with certain Farm Institute Schemes, and it was suggested that the Committee should now agree to vary the understanding so as to allow the Ministry to proceed with such Schemes where it was necessary to do so in order to relieve local trouble and irritation. This was agreed to on the further understanding that the spirit of the undertaking would continue to be observed. With regard to the Grant for Animal Disease Research, the Minister's suggestion that the Research Institute should be proceeded with at Cambridge University was approved.

(3) **Wart Disease Policy.**—As reported in Half-Yearly Report No. 3, the Potato Advisory Committee had recommended that the "1921 Policy," as opposed to a revised Policy which had been suggested by the Ministry with a view to financial economy, should be put into operation. The position was discussed by the Committee, and it was agreed that the Ministry should endeavour to carry out the "1921 Policy" with the smaller staff then available, the National Farmers' Union and other agricultural bodies being asked to do their utmost to assist the Ministry in the matter.

(4) **Sheep Scab Policy.**—The Committee considered the proposition which was made by the Ministry that an Order should be issued requiring after an interval of say 2 years that any owner having sheep, or selling sheep, affected with Scab should be liable to a heavy penalty unless he were able to

* See this *Journal*, June, 1922, p. 257.

show that he habitually took proper measures to cure, and to prevent the occurrence, or recurrence, of the disease. The Committee agreed with the proposals and considered that it was of importance that agricultural Unions and Societies should be asked to bring the proposed change to the notice of farmers, and that the Ministry's pamphlets dealing with the best means of eradicating Sheep Scab should be widely circulated. It was agreed that the date upon which the Order might become operative should be 1st May, 1924, and that the penalties might properly be a minimum of £5, with a maximum of £100. The Committee also considered that a Single-dipping Order for the whole country might be issued so as to encourage the universal dipping of sheep, in addition to the requirement of double-dipping (within a specified short period) in those cases where Sheep Scab was found to exist.

(5) **Seeds Regulations.**—Certain detailed amendments of the Seeds Regulations, 1921, were considered and approved. It was agreed that cereal seeds should for the present and pending further experience of the provisions continue to be scheduled under the Regulations.

(6) **Proposed Amendments of the Fertilisers and Feeding Stuffs Act, 1906.**—The Committee agreed to proposals which were submitted to them to the effect that the Ministry should have power, as in the case of the Seeds Act, to make Regulations of control rather than to have hard and fast provisions laid down in the Act itself. It did not consider that the provision requiring that the Ministry should give their consent before Local Authorities took legal proceedings under the Act should be abolished in any amendment of the Law. The doubtful value of some fertilisers which were sold as "mixtures" was commented upon and the Committee considered that it was necessary to take steps to safeguard the farmer in this respect.

(7) **Store Cattle from Canada.**—In view of the fact that Parliament had declared its opinion in favour of the importation of store cattle from Canada, the question of the precise nature of the precautions against the introduction of disease, etc., which should be adopted was referred to the Committee by the Minister at their Meeting on 2nd August. This question was considered as well as the position in regard to breeding stock from Canada. It was agreed that the period of detention and supervision would require to be a good deal longer in the latter case than in the former if breeding stock were also proposed to be admitted. The whole position was carefully gone into and various necessary safeguards indicated. It was understood that no store animals could be admitted until an Amending Act had passed through Parliament. It was agreed that drafts of any proposed Regulations under the Act when passed, should be submitted to the Committee for consideration before issue.

At a later Meeting on 1st November, 1922, the terms of the agreement which had been reached in Conference between representatives of the Home and the Canadian Governments as to the admission of Canadian cattle, were communicated to the Committee. The Committee agreed that all precautions possible appeared to have been taken to prevent disastrous results accruing to the cattle of this country. The terms of the agreement were afterwards published.*

* See this *Journal*, December, 1922, p. 770.

(8) **The Agricultural Situation.**—At the Meeting on 5th October, the Minister invited the observations of the Members of the Committee as to any suggested steps which the Government might take to alleviate the agricultural situation. He had himself considered it closely. The position in regard to a Scheme of Agricultural Credit, the Reform of Agricultural Rating, the differences between the Wholesale and Retail prices, importation of flour, the possible production of cheap nitrogenous fertiliser, railway rates on agricultural produce and other matters were discussed.

(9) **Irish Store Cattle Trade.**—At the Meeting on 5th October, the Minister informed the Committee that he was prepared to issue an Order reducing the period of observation under licence after sale from 13 to 6 days in the case of Irish store cattle coming into Scotland, and allowing sales to take place at all markets in Scotland instead of only at the limited number which had been indicated. The Committee concurred in the issue of the Order.

(10) **The Outbreak of Foot-and-Mouth Disease.**—The Committee was informed of the circumstances of the outbreak which commenced at Harmondsworth in Middlesex on the 20th October. This outbreak had occurred at the time of the Dairy Show and had entailed special precautionary restrictions in regard to animals at the Show. Other outbreaks had taken place at Woodstock in Oxfordshire, Walton-on-Thames, Windlesham and Staines. The Committee agreed that it was a fortunate circumstance in the case of this outbreak that no market had become infected and the disease was apparently being kept well in hand.

(11) **Reports on the Proceedings of the Various Advisory and Departmental Committees set up by the Ministry.**—Two quarterly reports were received by the Agricultural Advisory Committee, outlining the work done by the other Committees of the Ministry. The recommendation of the Warble Fly Committee that animals affected with Warbles should be treated with a dressing of tobacco and lime was specially referred to, and it was stated on behalf of the Ministry that the dressing had definitely been found to give the highest percentage of success in killing Warbles. On the Machinery Advisory Committee's Report the question was raised as to the requirement of the Ministry of Transport that breaks and bands on the front wheels should be fixed on tractors used for cultivation when they travelled along a road. It was arranged that the representatives of the Ministry of Agriculture should assist the National Farmers' Union in their representations to the Ministry of Transport in the matter.

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THE " MOSAIC " DISEASE OF THE HOP.

E. S. SALMON,

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Introductory.—For several years past an obscure disease has been showing itself in hop-gardens in this country. The diseased plant resembles in some features, *e.g.*, the shortened, non-climbing stems ("bines"), a hop attacked by the so-called "nettlehead" or "eelworm" disease, known to hop-growers

for more than a quarter of a century—and it is probable that hop-growers generally have not yet distinguished between the two diseases. Mr. C. A. W. Duffield, in his investigations into the "nettlehead" disease, first clearly pointed out the difference between the two diseases. In neither disease, it may be noted here, was Mr. Duffield able to find evidence that an eelworm is the cause.

The present article deals only with one of the diseases, which observations have shown to belong to the "mosaic" or "virus" group of plant diseases. The other disease, viz., "nettlehead," which also probably belongs to the same group, is neither so deadly in its effect nor so contagious.

Description of the Disease.—The disease is usually first noticed by the hop-grower when the plant has probably been infected for some time. In this condition (see Fig. 1-3*) the stems ("bines") have shortened joints, are unable to climb the string or pole and have a limited growth of from 4 to 6 ft. from the ground; the leaves are more or less curled, with *recurved* margins,† are more or less mottled green and yellow, and together with the upper part of the stem are noticeably brittle. All the affected bines with arrested growth remain barren. In this condition the "hill" of hops is doomed; the diseased shoots may either remain green through the season or they may die off during the summer; the roots when examined are found to be partly dead.

Less frequently—perhaps in those cases where the infection is recent—the bine reaches to the top of the string or pole and produces a varying amount of "hops," but the presence of the disease is shown, on careful examination, by the fact that some of the leaves are curled and mottled, particularly on the lateral branches, and that some of the hop-cones show curious and characteristic malformations. In the commercial hop-garden it is most probable, however, that those hills whose bines reach the top and produce "hops" are *not* recognised by the farmer as being diseased, with the result that the disease is spread by cuttings taken from such hills.

In rare cases of the "mosaic" disease, the tips of the "bines" and also of the lateral branches, die back a certain distance.

* The writer is indebted to Dr. Wormald for the photograph reproduced in Fig. 3.

† In the "nettlehead" disease, as Prof. J. Percival pointed out in 1895 (*Jour. S.E. Agric. College*, Vol. I, 1895, p. 5), the leaves show an *incurred* margin.

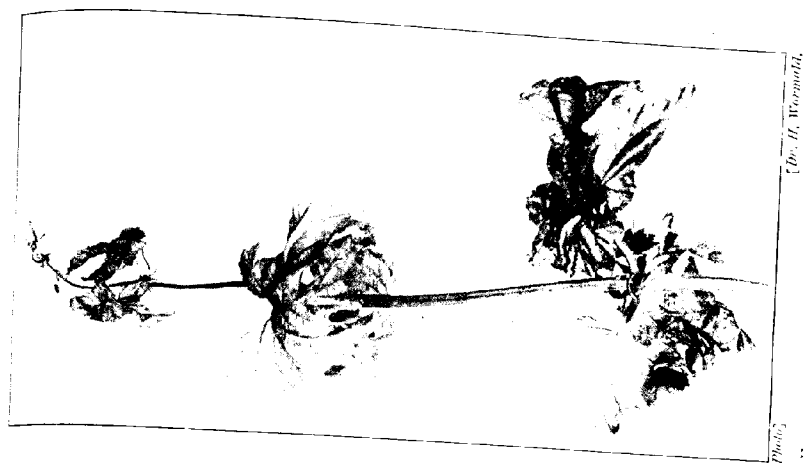


FIG. 2. Tippy portion of the plant shown in Fig. 1. The...

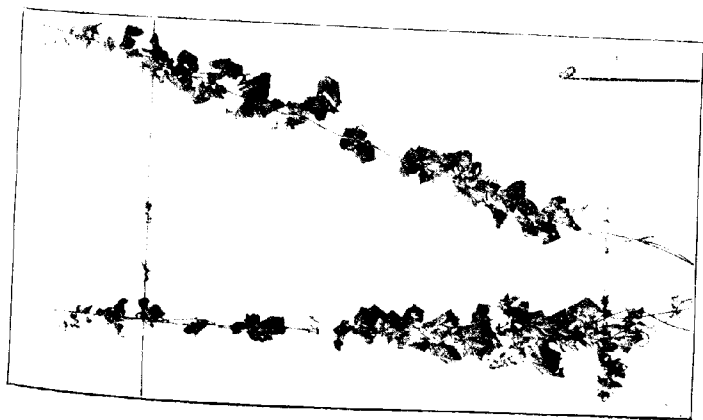


FIG. 1.—Showing five "Bins" of a Hop Plant severely attacked by "Mosaic Disease."

Nature of the Disease and its Spread.—The general appearance of the disease, and particularly the presence of " mosaic " (mottled green and yellow) areas in the leaves, suggest that the disease belongs to the group known as " mosaic " or " virus " diseases, of which the best known examples in this country are the " mosaic " disease of the potato and tomato, and the " leaf-curl " of the potato.* Prof. V. H. Blackman and his assistant, Miss Lacey, are at present engaged in carrying out investigations to ascertain, if possible, the cause of " mosaic " disease in the hop.

The object of this article is to draw the attention of the hop-grower to this apparently new disease, and to give evidence, collected in the hop-garden, which shows that *the disease is spread by means of cuttings taken from affected plants at a time when these are still apparently healthy*. The disease has been under observation for several years past both at Wye and at the East Malling Research Station. Some of the most striking cases showing how the disease can remain latent and be carried in cuttings taken from apparently normal plants are given below :—

Case I.—The hop-plant (Ref. No. B20) planted at Wye some time previous to 1906 remained apparently healthy until 1919, when it succumbed to the " mosaic " disease. Before this date the stock had been increased at Wye by the taking of cuttings which were planted in various places in the experimental Hop-garden ("nursery"). The history of these cuttings is as follows :—

Cuttings from B20.

<i>Ref. No. of cutting.</i>	<i>Date when planted.</i>	<i>Shown " mosaic " disease.</i>
D19	1910	1921
B19	1911	1915
C20	1911	1921
BB7 (from D19)	1919	1921
AA42 (from D19)	1919	1922
AA44 (from D19)	1919	1922
BB15 (from C20)	1919	1920
BB18 (from C20)	1919	1922
BB20 (from C20)	1919	1920

It will be seen from the above, that notwithstanding the taking of cuttings from apparently healthy plants the entire stock of B 20 at Wye died out from the " mosaic " disease. In the case of seven out of the nine cuttings mentioned, the neighbouring hop plants growing on either side of the cutting were free from the " mosaic " disease, so that it must be concluded that the

* In the United States " mosaic " diseases attack a large number of cultivated and wild plants, and have been extensively studied. Dr. W. W. Stockberger, of the United States Department of Agriculture, has informed the writer that no " mosaic " disease of the hop in America is known to him or his colleagues.

cuttings were infected at the time they were taken from the parent plant—a view which is strengthened by the similar evidence given by cuttings of B20 which were grown at East Malling.

These cuttings were taken in 1913 and 1914 from the apparently healthy parent-plant of B20 and its cuttings at Wye and planted in the nursery at East Malling Research Station; they were then planted out the next season,—one rooted "set" to the "hill,"—in a row of 35 "hills." The progressive appearance of the "mosaic" disease is shown in the following Table :—

<i>Hills affected with "mosaic" disease.</i>					
1914	...	...	...	...	2
1915	...	...	...	...	1
1916	...	...	...	...	11
1917	...	...	...	...	3
1918	...	...	...	...	0
1919	...	...	...	...	13
1920	..	...	...	...	9
					39*

The row was then grubbed up.

A second row of 35 hills of B20, derived similarly from cuttings taken from apparently healthy plants growing at Wye, was planted at East Malling in 1917. The fate of these plants was as follows :—

<i>Hills affected with "mosaic" disease.</i>	
1918	0
1919	27

The row was then grubbed up.

It seems clear, from the behaviour of the plants in other rows of new varieties which were being tested alongside the rows of B20 at East Malling, that the "mosaic" disease was carried in the cuttings of B20 from Wye to East Malling, and that they did not in this case become infected from some source present at the latter place. With regard to the second row of B20 planted at East Malling, the row of hops on one side was a variety (*Ref. No. P. 13*) which has never shown a hill affected with "mosaic" disease; and the row on the other side, consisting of another variety (*Ref. No. 38*) and the horticultural variety "Golden Hop," lost only seven out of the 35 hills, from the "mosaic" disease.

Case 2.—A seedling (*Ref. No. OC32*) was planted out at Wye in 1912: it remained apparently healthy until 1920, the plant being recorded in the field-book in 1919 as "healthy"; in 1920 all the shoots produced were severely affected with the "mosaic" disease. Another seedling (*Ref. No. OC33*) was planted in 1912 next to OC32; this plant showed malformed cones in 1919, indicating, probably, the first appearance of the "mosaic" disease, and the hill was therefore grubbed up. Cuttings were taken from both OC32 and OC33 during the years these two plants were apparently healthy and planted out both at Wye and East Malling. The fate of these cuttings is very instructive.

* Including some re-planted hills.

At Wye their record has been as follows :—

<i>Cuttings from OC32.</i>		<i>Planted.</i>	<i>Affected with</i> <i>" mosaic " disease.</i>
<i>Ref. No.</i>			
OX1		1914	1918
OX2		1914	1921
OX3		1914	1919†
OX4		1914	1921
I10		1915	1922
OA57 (from OX4)		1919	1920
OB7 (from OX2)		1919	1921
OB15 (from OX2)		1919	1922
			<i>Still apparently</i> <i>healthy.</i>
J49		1915	1922
OB1 (from OX4)		1919	1922
OB3 (from OX4)		1919	1922
OB8 (from OX2)		1919	1922
<i>Cuttings from OC33.</i>		<i>Planted.</i>	<i>Affected with</i> <i>" mosaic " disease.</i>
<i>Ref. No.</i>			
OX13		1914	1921‡
J29		1915	1922
184		1918	1922
205		1918	1922
W56 (from J29)		1921	1922
W39 (from J29)		1921	1922
			<i>Still apparently healthy.</i>
J32		1915	1922
44		1918	1922
126		1918	1922
W65 (from J32)		1921	1922

At East Malling, rows of OC32 and OC33, consisting of 35 hills each, were planted during 1918 and 1919; on either side of them were rows of other new seedlings (Ref. Nos. Y86, P43, L40, 458). The records of the rows OC32 and OC33 are as follows :—

<i>OC32.</i>						<i>Hills affected with</i> <i>" mosaic " disease.</i>
1919	...	...	...	...	...	1
1920	...	...	...	...	...	0
1921	...	...	...	...	...	29
This row was then grubbed up ...						30
<i>OC33.</i>						
1919	...	...	...	...	...	5
1920	...	...	...	...	...	0
1921	...	...	...	...	...	18
1922	...	...	...	...	...	25§
						48

During all this period not a single hill in the adjoining rows became affected with the disease. It can be safely concluded therefore that the very

‡ This plant was recorded in 1920 as " vigorous and very fruitful."

† " " " " 1918 " " very vigorous and fruitful."

§ Some of the " hops " were misshapen in 1920.

§ Including some re-planted hills.

severe outbreak of the "mosaic" disease in the rows of OC32 and OC33, resulting in the practical extermination of these rows, was due to the fact that the disease was carried in a dormant condition in the cuttings.

Case 3.—In 1911 a seedling (Ref. No. L5) was planted out at Wye. This plant remained vigorous and fruitful until 1917, when it succumbed to "mosaic" disease. Cuttings were taken from it while it was still apparently healthy, and planted out in widely separated places in the Experimental Hop-garden (Nursery) at Wye. The fate of these cuttings was as follows :—

<i>Ref. No. of cutting.</i>	<i>Date when planted.</i>	<i>Affected with " mosaic " disease.</i>
S69	1911	1915
380	1912	1914
CC16	1915	1921
CC17	1915	1921
OA18	1916	1917
OB50	1915	1922
OB59	1916	1920

None of the plants growing on either side of these cuttings of L5 were affected with the "mosaic" disease. Here again it appears clear that the spread of the disease was effected by cuttings taken from an apparently healthy plant. It is interesting to note that two of the cuttings succumbed to the disease 2 and 3 years respectively before the parent-plant showed the disease.

Numerous other cases have been met with, all giving evidence that the "mosaic" disease is carried in cuttings.

Experiments in Treating Diseased Hills.—Before discussing the best methods of control, some experiments in treating diseased hills may be mentioned here. During the season of 1922 the experiment was tried, at the East Malling Research Station by Mr. J. Amos and the writer, of "pulling" early in the season (June) the diseased shoots of "hills" affected with "mosaic" disease, with the idea that shoots arising later might prove to be healthy. The details of these experiments will be given elsewhere, but it may be mentioned here that no success from the practical standpoint, resulted from this treatment. Of 216 affected hills, where the vines were "pulled," 160 (*i.e.*, 74 per cent.) produced no fresh shoots, resulting, of course, in the death of the hill. Fifty-six hills produced fresh shoots, and in 40 cases these shoots were clearly affected with the "mosaic" disease. In only 5 cases, *i.e.*, in a little over 2 per cent. of the total number of hills "pulled," were the new shoots that were produced apparently healthy. The writer carried out the same treatment of diseased hills at Wye: here, out of 173 treated hills, 122 (*i.e.*, 71 per cent.) produced no fresh shoots; 32 hills produced again diseased shoots, and 7 plants, *i.e.*, 4 per cent., produced shoots which were apparently healthy.

Control Measures.—The full control of the " mosaic " disease of the hop cannot be hoped for until the exact cause of the disease and the manner of infection are known. Prof. V. H. Blackman, F.R.S., and Miss Lacey have now commenced investigations along the lines which have proved successful in other diseases of this type.

In the meantime, however, considering the havoc that " mosaic " diseases are causing in many agricultural crops and that severe outbreaks of the mosaic disease in hops have already occurred in Kent and other hop-growing counties, it is desirable that the hop-grower should take steps at once to check the spread of the disease, as far as possible, by adopting the following control measures.

1. Where the " mosaic " disease is recognised, the affected " hill " should be *grubbed up at once*. There is reason to believe that the " green-fly " (Aphis), and possibly other insects, spread the disease from an infected plant to healthy ones.

2. When an affected hill is seen, the adjoining " hills " should be *carefully scrutinised* for the detection of the first signs of the disease, and every hill showing symptoms of the disease should be grubbed up at once. A systematic examination of the hop garden should be made during June and again just before hop-picking.

3. The spread of the disease is undoubtedly taking place through the use of cuttings taken from affected hills and from hills which appear healthy and yet carry the germs of the disease. Drastic measures are necessary in order to stop this spread of the disease. Either no cuttings should be taken at all from a hop garden in which the " mosaic " disease has occurred, or, if that is impracticable, then, either (1) no cuttings should be taken from *that part of the garden* where the disease has occurred, or (2) no cuttings should be taken from the " hills " contiguous to the diseased " hill " that has been grubbed up.

The nearer the practice can be followed of not taking any cuttings from a garden where the " mosaic " disease has occurred, the greater will be the likelihood of checking the spread of this new disease.

Summary.—1. The " mosaic " disease of the hop—which is apparently similar in many respects to the well-known " mosaic " diseases of the potato, tomato, tobacco and other plants—is proving extremely destructive and very contagious.

The hop-plant once attacked never recovers and is usually killed in one or two seasons; an infected plant not grubbed up serves as a source of infection which quickly spreads the disease.

2. Observations have shown that the disease can be carried in the cuttings of hop-plants.

3. The systematic "rogueing" of hop gardens in early summer and again just before hop picking is recommended to prevent the spread of the disease.

* * * * *

BRITISH APPLES AT THE SECOND IMPERIAL FRUIT SHOW.

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and Fisheries.*

An article dealing with the general entries, British Empire Apple Section, and with pears and grapes was published in this *Journal* for December, p. 788.

Dessert Apples.—To meet the wishes of the apple growers. Sectional Classes were provided for the Kent and Southern, the Eastern and Northern, and the West and Midland growers, and for each section a group of Judges was selected to make the awards. The Section Cards showing the marks awarded to exhibits in the Sections have already been made public, and each competitor has had a chance of discovering his strong and weak points. The prize-winning exhibits in the Sectional Classes were then rejudged for the premier awards in the classes open to growers in Great Britain. A few comments on the best may be of some educational value.

Cox's Orange Pippin.—The first class was for 6 boxes of Cox's Orange Pippin, and it would be difficult to imagine much better fruit than the winning exhibits in the three sections. All these apples were about the same size—200 to the box, packed 3—2. 8—8. All were highly coloured, well finished, and evenly packed. When judged for the Great Britain Section the Hereford exhibit proved free from blemish and slightly more uniform than the others, and gained the 1st prize by 2 points. The University of Reading exhibit secured one mark less, and one mark more than the Cox's from Cambridge, which were packed less solid. The size of apple selected in many of the other

exhibits was too small; in others so large that only 163 to the box could be packed.

At the sale all three prize winners realised much higher prices than the winning Cox's in the Empire Section. This was generally expected, for in this year's competition the best exhibits were entered in the Sectional Classes.

The Cox's Orange Pippin packed in half sieves were no less good, and both for condition of the fruit and the quality of the pack, the best exhibit came from that noted fruit growing county Devonshire. This secured first prize in the West and Midlands Section, first in the Great Britain Section, and two specials. The Herefordshire Cox's came second. The West Country thus demonstrates ability to produce good fruit where efforts are made to master the processes of grading and packing.

The average prices of Cox's Orange Pippin were as follows :—

		Average price per box (40 lb.)	Average price per half-sieve of 20 lb.
		£ s. d.	£ s. d.
Kent and Southern Counties Section	...	1 6 7	0 12 4
East and Northern Section	...	1 1 3	0 10 10
West and Midlands Section	...	1 1 7	—

Worcester Pearmain.—The best two exhibits—the first from Hereford and the second from Cambridge—were packed 3—2, 8—7 but in each the pack lacked solidity and points were lost in both cases. As the show proceeded the condition of the fruit rapidly deteriorated, and apart from the winning exhibits realised moderate prices at the auction sale, the average being 10s 1d. per box of 40 lb.

King of the Pippins.—Good samples of this variety look well when properly packed, but really good clean samples are difficult to obtain in quantity. The exhibit from Herefordshire was by many points superior to the rest, and for colour, finish, skin quality, and general brightness it was as fine a lot of Kings as it was possible to obtain, points only being lost on wrapping and packing. This exhibit and the second prize winner (from Cambridgeshire) were packed 3—2, 7—8, which would appear suitable for this dessert variety. At the sale, the prices averaged 8s. per box for the Kent and Southern Section, 11s. per box for the Eastern Counties Section, and 6s. per box for the West and Midlands Section.

Allington Pippin.—The best exhibit of this variety also came from Hereford, and it gained because of superior colour and

brightness. East Suffolk secured the second prize. The best exhibit from Kent—at one time the home of the Allington—was placed third, points generally being lost for a slack pack. Prices were generally about 8s. to 9s. per box.

Blenheim Orange.—This apple has long been famous in the West Country, and it was general expected that the exhibits of Blenheims in the West and Midlands Section would be good. Curious to relate, however, the best Blenheims (12 boxes) were staged by the only fruit grower in Warwickshire to exhibit at the Show and there was little to choose between his two lots, which secured both first and second prizes. These apples were rather large for dessert, but their even shape, clear skin and bright colour looked tempting, and more than one visitor to the show declared these the best apples in the competition. These two exhibits realised 24s. and 21s. per box at the sale, thus supporting the judges' decision. Prices generally averaged 12s. 6d. per box of 40 lb.

Other Dessert Varieties.—Many interesting varieties were shown in the "other variety" class, such as Gascoyne Scarlet, Charles Ross (many exhibits), James Grieve, Small Newton Wonder, Wealthy Winter, Quinning, Barnack Beauty, and Rival. The names of all these were attached to the exhibits for educational purposes—a feature which made the show more attractive.

From a general consideration of the size of apple in prize exhibits, it would appear that for dessert apples the best size for packing, except for a large variety such as Blenheim, is 3—2. 7—8, though if this fails to give a tight pack it may be better to use a slightly smaller apple and pack 3—2. 8—8. The apples should be uniform in size, of the correct shape, and with a fine bright skin free from blemish and provided with plenty of colour. Boxes so packed not only secure good marks from the Judges but correspondingly satisfactory prices when sold. (For example, the Cox's Orange Pippin in the Kent Section, where three exhibits recorded by the Judges as below show standard realised but 22s., 22s. and 20s. per box by auction, but those securing marks of 68, 69, 73, 76, 82, 88, 90 and 92 realised 25s., 26s., 31s., 31s., 23s., 38s., 38s. and 44s. per box; the Blenheim Orange in the West and Midlands Section, with Judges' marks of 57, 69, 73, 75, 84, 94 and 97, realised at the auction 10s., 13s., 14s., 14s., 14s., 21s. and 24s. per box.)

Cooking Apples.—*Bramley Seedling.*—Excellent samples of both green and crimson Bramleys were shown in both barrels and bushels and it was generally agreed that these packages are

more suitable than boxes for this variety. The first prize exhibit from Kent in the Great Britain Section won because of superior size, 16 apples only being needed for the top layer. The second exhibit was packed 20 to the layer. The condition generally of this variety was exceedingly good, though most apples were on the small size. It may be of interest here to compare the average prices made by the Bramleys in the barrels compared with the smaller weight in the bushels, and arranging prices sectionally they were as follows:—

	<i>Kent Section.</i>	<i>Eastern Counties Section.</i>	<i>West and Midlands Section.</i>
Barrels (60 lb.) ...	16/9	13/9	16/1
Bushels (40 lb.) ...	8/2	8/-	11/3

Newton Wonder.—The Newton Wonder apples were exceptionally fine and the weather conditions in 1922 proved favourable to this variety. Whether packed in barrels, bushels or boxes, the exhibits looked very attractive, this variety lending itself well to display. The best exhibit was grown in Worcestershire. The fruit was of good quality and condition and possessed plenty of colour. The packing was slightly better than that of the second, but the only full marks awarded for method of ringing in were for an unplaced Kent exhibit which had 17 apples on the top layer, finishing with one in the middle.

Prices for barrels of Newton Wonder were generally good, the average being—Kent and Southern Counties Section 16s. 8d. per barrel; Eastern Counties Section 12s. 5d. per barrel; and West and Midlands Section 15s. 11d. per barrel.

Lane's Prince Albert.—This variety has long been a popular commercial apple, but on few occasions have such excellent samples been collected as were shown in boxes, barrels and bushels on the present occasion. Competition was very keen, and only samples with bright skins and possessed of the conspicuous red stripes secured prizes. The first prize winner (Worcestershire grown) was many points superior to the others. The apples were large, the top layer consisting of but 14, of which four were in the middle. The eyes were turned towards the centre making a really attractive exhibit. Prices for Lane's were good and several exhibits made more than 20s. per barrel, whilst the average prices were as follows:—For Kent and Southern Section, 12s. per barrel; Eastern Counties Section, 13s. 5d. per barrel; and West and Midlands Section, 14s. 3d. per barrel.

Other Cooking Varieties.—In the "other variety" class, Lord Derby, a favourite in the Eastern Counties, was largely shown.

There were 'also Large Charles Ross and Blenheim, Gascoyne Scarlet, Wellingtons, Annie Elizabeth, and five exhibits of King Edward VII and Encore. Both of these new varieties are thought to have great commercial possibilities as late culinary varieties. Again all these exhibits bore names for educational purposes.

Of the many fine exhibits in the barrel class one lot of Lord Derby from Cambridge scored many points above the others mainly because of superior packing, which showed an exceptionally good and even finish. There were 13 apples on the top layer with three in the middle. This exhibit won two first prizes and sold for the high figure of 80s. per barrel.

The culinary prizes in bushels proved an attractive exhibit. The first prize, for highly coloured good quality apples from Wisbech, was packed 20 to the layer with one in the centre. This realised 24s. per bushel. The second prize was awarded to an exhibit of King Edward VII, Cambridge grown, which sold for 16s. per bushel.

Notes.—General considerations would suggest that size, colour, quality, and good packing are the essential points for cooking apples, no matter whether for the Judges' adjudication or for sale. It was suggested that the best method of judging cooking apples would be to award the prizes to those exhibits that made the most money. Whilst exhibitors might complain if this method were adopted, a comparison showed that the Judges' section cards and the prices realised run almost parallel, both for the dessert apples, of which a few instances have been quoted, as well as for the cooking. For instance, in the class for six barrels of Lane's Prince Albert (Kent Section) the marks were 69, 73, 78, 80, 83, 86, 87, 90, 91, 92, and the auction prices 10s., 11s., 11s., 11s., 12s., 12s., 15s., 13s., 15s., 17s. For the Newton Wonder in the West and Midlands, Judges' marks were 71, 75, 79, 85, 85, 88, 89, 90, 90, 92, 96, 97, and the prices 14s., 12s., 18s., 18s., 18s., 17s., 16s., 15s., 17s., 18s., 20s., 27s. The figures run too consistently on parallel lines to be a mere accident.

The box and the half sieve for dessert apples, and the barrel and sieve for culinary, find champions and opponents in every market, and it may be interesting to give figures of the prices realised at the auction sale. These were as follows:—

There were in all 798 boxes of dessert apples which, on account of the low prices realised for the Worcester and Allington, and bad specimens of Kings, only averaged 18s. 8d. per box of

40 lb. There were 368 half sieves which realised an average of 8s. 2d. per package; which seems to indicate its value as a commercial package still of value. It must be remembered, however, that in a large majority of cases the apples in the half sieves were Cox's Orange Pippin.

The comparison amongst cooking varieties is made easier because of the more level standard of quality recognised for this purpose. There were in all 852 half barrels (60 lb.) which sold for an average price of 14s. 6d.; and 360 bushel sieves (40 lb.) which realised 8s. 7d. per package. This would indicate an advantage for the half barrel as a sound commercial package for cooking apples.

Besides the educational and immediate commercial advantage of this show to the exhibitors, it will tend to stimulate growers to improve their methods of grading and packing, when their difficulties in competing in the home markets against imported produce will become less.

* * * * *

THE VALUE OF A FIRST CROSS IN THE PRODUCTION OF PORK AND BACON.

It is a commonly held view that, in the production of pork or bacon, it is a sound commercial proposition to use a first cross. The reasons advanced are twofold: (1) a suitable first cross gives an ideal side of the bacon, and (2) the first cross matures more quickly and costs less to feed.

An experiment on commercial lines carried out at the Lord Wandsworth Institution at Long Sutton, Hampshire, during the winter of 1921 is of interest in this connection, since the results of the trial indicate that a first cross does mature more quickly and is more economical to feed. Unfortunately the data available do not extend to the slaughter stage, considerations of a purely commercial nature, such as selection for breeding and marketing facilities, precluding the comparison of the data beyond the fourth month of feeding.

In the trial, nine pure bred Large Black pigs were compared with nine Berkshire-Large Black crosses. At the commencement of the trial, 13th October, 1921, the pigs were eight weeks old. The pigs in both lots received identical treatment throughout.

both with regard to feeding and management, and the results obtained may be safely attributed to the difference due to the first cross.

For the first two months both lots of pigs received the same quantity of food, but as the cross breeds thrived much better, it was found necessary to feed them a little more generously in the latter stages of the trial. In both cases, the pigs were given as much meal as they would eagerly clear up at each meal. The exact particulars as to meals fed are as follows:—

Pure Breeds.

1st 28 days. Consumed 218½ lb. toppings, 105¾ lb. barley meal, 105¾ lb. maize germ meal 430 lb. mixed meals, and 112 lb. skim milk.

2nd 28 days. Consumed 181½ lb. toppings, 237¼ lb. barley meal, 237¼ lb. maize germ meal, 89 lb. palm kernel meal—745 lb. mixed meals, plus 112 lb. skim milk.

3rd 28 days. Consumed 1,024 lb. of meal consisting of 357½ lb. palm kernel, 309¾ lb. maize germ and 357½ lb. barley meal, together with 112 lb. skim milk and 112 lb. green kale.

In 29 days. Consumed 1,220 lb. of meal consisting of equal parts of palm kernel, maize germ and barley meal, together with 4 lb. of kale, 73 lb. mangolds and 120 lb. skim milk.

Cross Breeds.

1st 28 days. Consumed 218½ lb. toppings, 105¾ lb. barley meal, 105¾ lb. maize germ meal 430 lb. mixed meal, plus 112 lb. separated milk.

2nd 28 days. Consumed 181½ lb. toppings, 240¼ lb. barley meal, 240¼ lb. maize germ meal, 92 lb. palm kernel meal—754 lb. meal, plus 112 lb. skim milk.

3rd 28 days. Consumed 1,139 lb. of meal consisting of 399½ lb. palm kernel, 399½ lb. barley meal, 339¾ lb. maize germ meal, together with 112 lb. of skim milk and 112 lb. kale.

In 29 days. Consumed 1,444 lb. of meal consisting of equal parts of palm kernel, maize germ and barley meal, together with 4 lb. of green kale, 73 lb. mangolds and 120 lb. skim milk.

The weights of the pigs were as follows:—

Pure Breeds.

age.	lb.
8 weeks (Beginning of trial)	232
End of 1st 28 days	408
" " 2nd 28 days	655
" " 3rd 28 days	964
" " final 29 days	1,279

Cross Breeds.

age.	lb.
8 weeks (Beginning of trial)	271
End of 1st 28 days	451
" " 2nd 28 days	718
" " 3rd 28 days	1,083
" " final 29 days	1,502

The nine pure bred pigs gained 1,047 lb. during the trial and consumed 3,419 lb. of mixed meals plus 456 lb. of skim milk, 116 lb. of green kale and 73 lb. of mangolds = approximately 3,503 lb. of food reckoned as mixed meals.

The nine cross bred pigs gained 1,231 lb. during the trial and consumed 3,767 lb. of mixed meals plus 456 lb. of skim milk, 116 lb. of green kale and 73 lb. of mangolds = approximately 3,851 lb. of food reckoned as mixed meals.

From the above data, it will be seen that the cross breeds matured more quickly. For each lb. of live weight increase put

on by the pure breds, 3.3 lb. of meal were required, whereas the cross breds required only 3.1 lb. of meal for every lb. of live weight increase.

These results indicate that, where circumstances allow, the first cross between two pedigree pigs is desirable if used for commercial purposes. It must, however, be clearly borne in mind that these remarks apply only to the first cross and do not apply to all cross breds, i.e., cross breds resulting from second or third crosses, or what can be regarded as a mongrel type of pig.

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DOES GOOD FARMING PAY?

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The following note has been contributed by Mr. Orwin in reply to Sir John Russell's observations on the subject in the issue of this JOURNAL for November, 1922, p. 752.

In the November *Journal* there appears an article by Sir John Russell, under the title "Does Good Farming Pay?" which raises a point of greatest importance to farmers to-day. Applying to the words their strictest meaning the answer to the question can only be "Yes," because if farming does not pay, it cannot be good. It is evident from the context, however, that for the purpose of the article "good farming" is taken as being synonymous with "high farming"—the general truth of which is open to question.

Reference is then made to a series of very interesting experiments conducted by Lawes, on the manuring of wheat, which were used by him to illustrate the Law of Diminishing Returns as applying to agriculture. Those experiments had long been buried and forgotten in an obscure paper until they were dug up a few years ago by Sir Daniel Hall and re-stated by him in graphic form. In them plots of wheat were given equal treatment except that varying quantities of nitrogenous fertilisers were applied, the dose increasing at a uniform rate from plot to plot. The results showed that whereas the manurial costs rose from plot to plot on a uniformly ascending scale, the crop increase due to additional fertiliser was less and less, so that ultimately a point was reached at which the increase in crop was insufficient to pay for the increase in fertiliser.

Sir John Lawes, starting apparently with a very unproductive soil, used most extravagant quantities of nitrogenous manure for the purposes of his experiment, and accordingly Sir John Russell suggests that the results have no value as a guide to the farmer upon the wisdom or otherwise of "high farming" to-day. In support of this suggestion he quotes a recent experiment (1921) carried out at the Midland Agricultural College, upon potatoes, where the manures used bore a closer relation, as to quantity, to current farming practice, and which he interprets to prove that "if it pays to grow a crop at all it pays to grow a good one." (Again the writer must be presumed to be judging of goodness by a quantity standard only.)

The results of the Midland Agricultural College experiment, as stated by Sir John Russell, are as follows:—

Plot.	Manuring.		Yield in tons per acre.	Percentage Ware.	Percentage Seed.	Value of Crop at £6 per ton. Seed and Chats at £2 per ton.	Cost of extra manure at 4/- phosphate, 15/- cwt. Sulph. Amm. 15/- cwt. Sulphate of Potash.		Profit or loss from additional dressing.
	Dung.	Artificial.					£ s. d.	£ s. d.	
1	12 tons	6 cwt.	11.31	53.1	42.3	46 13 0	—	—	—
2	12 "	8 "	13.63	56.9	39.3	58 5 0	0 17 0	+10 10 0	
3	12 "	10 "	14.36	60.6	35.7	63 10 0	1 14 0	+15 3 0	
4	12 "	12 "	13.19	61.7	33.2	58 18 0	2 11 0	+ 9 14 0	
5	12 "	14 "	13.18	52.9	41.2	54 5 0	3 8 0	+ 4 4 0	
6	12 "	16 "	11.34	58.4	38.3	49 3 0	5 4 0	— 1 15 0	

So far from proving that Lawes' work and conclusions "cannot properly be quoted in relation to the modern problem" these experiments are an admirable confirmation of them. They show, in connection with a different crop and with a scheme of manuring more closely related to normal farming practice, results exactly comparable with his. The rate of crop-increase, which is very considerable under the smaller doses of manure, is slower and slower as more and more fertiliser is applied.

Now the practical application of Lawes' experiment is not that the farmer should never attempt to increase his crops in times of low prices, but that the measure of the attempt must always be determined in relation to the market valuation of the product concerned. In other words, the profitableness of any

expenditure upon fertilisers is dependent upon current prices. This is exactly what is proved in the experiment cited by Sir John Russell. The prices quoted for the potato crop by him are now nothing more than a happy memory. The figures given in the press to-day for Arran Chiefs are from £2 10s. to £3 5s. per ton, for ware, *ex* Borough Market, and if we take these figures as equivalent to an average price of £2 per ton on the farm, and then allow £1 for chaffs we shall have, probably, a close approximation to the facts. Recalculating Sir John Russell's results in these terms we get the following figures:—

Plot.	Profit or loss from additional dressings at prices used by Sir John Russell:—			Profit or loss from additional dressings at prices current to-day:—		
	£	s.	d.	£	s.	d.
2	+	10	15 0	.....	3	4 0
3	+	15	3 0	.....	4	0 0
4	+	9	14 0	.....	1	9 0
5	+	4	4 0	.....	0	13 8
6	—	1	15 0	.....	3	14 3

At Sir John Russell's prices the earlier increments of fertiliser pay, whilst the later ones do not; at prices now current the first increment shows a profit, the second pays its way as compared with the first, the third shows a loss compared with either first or second, whilst the two last show an actual loss. What better confirmation could there be of Sir John Lawes' figures? When prices are low the farmer cannot afford to go out for the increased production that would pay him at higher prices.

There is, however, still another consideration involved, and that a most important one. Taking Sir John Russell's figures for the potato crop as they stand, the whole value of his conclusions as to profit and loss depends upon the assumption that there was a profit (or, at all events, no loss) on the production of the basic crop on Plot 1. In 1921 farming costs reached their maximum, and it may well be that a crop of potatoes amounting to 11.31 tons which sold for £46 13s. was produced at a loss. Knowledge of the total cost of the basic crop is fundamental to the proper interpretation of the table: without it the whole experiment and others on similar lines are really worthless as regards the purpose to which they are applied here.

At Rothamsted, in 1920, the cost of the potato crop was £57 9s., and the yield about 5 tons. Labour, the principal item in cost, had risen in 1921 by about 10 per cent. contrasted with the previous year, so that it may be assumed that the crop in 1921 cost well over £12 per ton for ware and chaffs together.

when the market value, according to the table, was £6 per ton for 53 per cent. of the crop, and £2 per ton for the remainder. Even if the crop in the Midland experiment cost no more for nearly twice as much in produce—which is unlikely—it is clear that its cultivation must have involved a heavy loss, and that none of the “profits” indicated as the result of the increasing manuring ever materialised. It is stated in the article that “it is quite obvious that the heaviest dressing (16 cwt. artificials per acre in addition to 12 tons farmyard manure) has not paid; nor has 14 cwt. paid as well as 12 cwt.; but it would be quite wrong to argue that therefore a farmer should not use artificials at all.” The only possible argument, however, is that with costs on the scale obtaining in 1921 and markets as they were no system of manuring or anything else could produce potatoes at a profit. When we come to substitute crop values prevailing to-day for those used by Sir John Russell, and to realise that the basic plot produced potatoes of a total value of no more than £17 per acre, the fallacy underlying the attempt to make the crop pay by spending more money needs no argument.

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NOTES ON MANURES FOR JANUARY.

SIR JOHN RUSSELL, D.Sc., F.R.S.,

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Town Refuse as Manure.—Further particulars have been furnished of the town refuse material prepared by the County Borough of Halifax. An analysis has already been given in the *Journal* (Nov., 1922, p. 685), showing that it contains 21.7 per cent. of organic matter and 2.13 per cent. of nitrogen: it is prepared by mixing the riddled dust from bin refuse with the contents of the pail closets, and the resulting product is comparatively free from odour and is easily handled. It is understood that some 16,000 tons per annum could be prepared, which would be a useful addition to the fertiliser resources of the district. A cheap organic manure is a great help in farming.

Arable Crops on ploughed out Grassland.—It is well recognised that improvement in grassland effected by basic slag is continued in arable crops taken if, and when, the land is broken up. This is an important point where the rotation involves leaving the land in grass for several years, as often happens in

the west and north, the grass then being broken up for a succession of arable crops. An interesting illustration, is furnished by the experiments made by Mr. A. W. Oldershaw at Saxmundham. A grass area was divided into two parts: one was manured with 10 cwt. per acre of basic slag in 1904 and again in 1912; the other was left unmanured. Both parts were grazed with sheep. The slagged one did the better and gave a profit after paying for the manure, which averaged 17s. 2d. per acre each year. The land was then broken up and cropped: the slagged area still continues to give the heavier crops. The results have been as follows:—

	1919 Mixed Beans and Peas.	1920 Wheat.	1921 Barley.	Crop 1922 Mangolds.
<i>Plot 1.</i> No Manure on grass 1904 and 1912	29.7 bush. Corn 12 cwt. Straw	29½ bush. Corn 35 cwt. Straw	31½ bush. Part of plot subsoiled in Feb., 1922	tons cwt. Subsoiled ... 23 15 Not subsoiled 23 15
<i>Plot 2.</i> 10 cwt. Basic slag in 1904 and again in 1912	40 bush Corn 62 cwt. Straw	38.8 bush. Corn 45 cwt. Straw	43½ bush. Part of plot subsoiled in Feb., 1922	Subsoiled ... 28 4 Not subsoiled 26 10

The additional yields on the slagged area are no doubt connected with the development of wild white clover, though it must also be remembered that the particular type of soil at Saxmundham responds to phosphates.

It is interesting to note that subsoiling had no visible effect on the yield of mangolds on the unslagged plot, while an additional 34 cwt. were produced on the subsoiled part of the slagged plot.

Effect of Manures on Barley Crop.—An experiment was carried out this year by the Rothamsted Experimental Station under the Research Scheme of the Brewers' Institute in which barley was grown on a number of farms under fertiliser treatment designed to meet various special conditions. The results already known afford interesting evidence of the room for improvement in the fertiliser treatment of even so well understood a crop as this.

An interesting case is furnished from a well managed farm on very light land in Suffolk, on which barley has been well and successfully grown for a number of years. The average yield on the farms in the immediate neighbourhood was this year

about 20 bushels per acre. On the experimental plots the yields were as follows:—

	bush. per acre.
No manure	16
Complete artificials (a good general dressing) ..	21½
Nitrogen and Potash only (specially suited to light land)	27½

These figures illustrate the important principle that the manurial scheme should suit the local conditions: the good general all-round manure is not as effective as the one specially adapted to the particular field. The difference in result between the special and the general manure is easily explained: phosphates are well known to hasten the ripening of crops, and they may actually prove detrimental to the yield on a light sandy soil where cereals usually ripen off quite early enough. Potash, on the other hand, encourages the prolonged activity of the plant's life process, which is the thing needful on a light soil. A combination of nitrogenous and potassic fertiliser would therefore be expected to act better for barley on a light sandy soil in dry condition than a complete fertiliser. The safest principle in manuring is to start with a good general mixture as basis, and then modify it to suit the particular farm by reducing the quantity of constituents not particularly needed there—if necessary omitting them altogether—and increasing the quantity of constituents which are particularly effective.

Manuring for Potatoes.—The results of last year's experiments are beginning to come in and they already show certain features of interest. During the War years some of the potato growers, finding they obtained fair or even good crops without the use of potassic fertilisers, began to ask whether potash really is necessary for potatoes. Experiments have therefore been started to see what effects are produced. The yields at Rothamsted this season were:—

Without Farmyard Manure.

	tons per acre.
No manure	3.0
Artificials <i>without</i> potash: Superphosphate 6 cwt., Sulphate of ammonia 2 cwt. per acre	2.5
Artificials <i>with</i> potash as above + sulphate of potash 2 cwt. or muriate of potash 1.7 cwt. per acre ...	8.3

With Farmyard Manure.

(10 tons per acre).

	tons per acre.
Artificials <i>without</i> potash: superphosphate 4 cwt., sulphate of ammonia 1½ cwt.	8.0
Artificials <i>with</i> potash as above + sulphate of potash 1½ cwt. ... + muriate of potash 1.3 cwt. ...	9.6 9.2

During this season therefore the effect of potash has been very marked, especially in the absence of farmyard manure; while even with a good dressing of this substance the effect was still shown.

The results bring out a feature which was shown at several of the centres this season: in absence of farmyard manure, or where small dressings only can be given, the artificials must be very carefully chosen if any useful result is to be obtained. The mixture of 6 cwt. of superphosphate and 2 cwt. of sulphate of ammonia proved wholly unsuitable: from the outset the plots could be picked out by the dark, unhealthy look of the leaves and the stunted growth of the plants: indeed, the appearance was inferior to that of the wholly unmanured plot, and in the end the crop was the poorest of the set, being only on an average $2\frac{1}{2}$ tons per acre, while the unmanured plots had yielded on an average 3 tons per acre. When the fertiliser, however, was made complete by the addition of potash the yield jumped from $2\frac{1}{2}$ tons to 3 tons 6 cwt.—an addition of nearly 6 tons of potatoes as a result of adding 2 cwt. of sulphate of potash or 1.7 cwt. of muriate of potash. Experience at other centres suggests that this mixture might be even further improved.

Where farmyard manure is added the crops are somewhat larger, but as the limit for potatoes on our soil seems to be about 10 tons per acre there was not much margin left for improvement, and the addition of potash to the incomplete artificials has raised the yield from 8 tons per acre to 9 tons 12 cwt. in the case of sulphate of potash, or 9 tons 4 cwt. in that of muriate of potash—an additional 1 ton 12 cwt. of potatoes for the use of $1\frac{1}{2}$ cwt. of sulphate of potash, or 1 ton 4 cwt. for the use of $1\frac{1}{2}$ cwt. of muriate of potash—quite a useful increase which at normal prices would have given a good profit.

Does Manuring Pay?—The above paragraphs show that the expenditure on the manure—provided a suitable mixture was used—was well justified. The $8\frac{1}{2}$ or $9\frac{1}{2}$ tons of potatoes per acre will at present prices not bring a profit, but they will not involve us in the serious loss attached to the yields of $2\frac{1}{2}$ or 3 tons per acre which we should have obtained had we tried to save the manure bill. If we had known that prices would be down to £2 per ton to the grower we should not of course have touched the potato crop, but having grown it we have come out better with the big crop obtained by the use of a proper fertiliser mixture, than we have from the smaller crops grown with less or no fertiliser. The outgoings are not widely different in the

two cases, but the incomings are. The way to meet the difficulty is to bring down the other charges and so reduce the total cost of production.

Prices of Artificial Manures.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are nett cash for prompt delivery.

DESCRIPTION	Price per ton				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ...	...	13.15	13.5	13.5	17. 1
" " Lime (N. 13 per cent.) ...	...	...	...	11.17	18. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	15.10*	15.10*	15.10*	15.10*	(N)14-11
" " " neutral (A. 25¾ per cent.)	16.13*	16.13*	16.13*	16.13*	(N)15.8
Kainit (Pot. 12½ per cent.) ...	...	...	2.12	2.0	3. 2
French Kainit (Pot. 14 per cent.) ...	2. 5	2. 1	...	2. 5	3. 3
Sylvinit (Pot. 20 per cent.) ...	...	...	...	3. 2	3. 1
Potash Salts (Pot. 30 per cent.) ...	...	...	...	4.15	3. 2
Muriate of Potash (Pot. 50 per cent.) ...	...	10. 7†	9. 0	9. 0	3. 7
Sulphate of Potash (Pot. 48 per cent.) ...	...	13.12†	12. 0	12. 0	5. 0
Basic Slag (T.P. 30-32 per cent.) ...	3.15§	...	...	4. 2§	2. 8
" " (T.P. 24-26 per cent.) ...	...	21.13§	...	...	...
" " (T.P. 20-22 per cent.) ...	2.12§	2. 5§	2.15§	2.15§	2. 7
" " (T.P. 16-18 per cent.) ...	2. 2§	...	2. 8§	12.3§	3. 2
Slag Phosphate (T.P. 60 per cent.) ...	6. 7§	...	...	6.15§	2. 3
" " (T.P. 50 per cent.) ...	...	...	5.10§	5.15§	2. 4
" " (T.P. 40 per cent.) ...	4. 7§	...	...	...	...
Superphosphate (S.P. 35 per cent.) ...	3.17	...	4. 2§	3.12	2. 1
" " (S.P. 30 per cent.) ...	3. 7	3. 0	3.10§	3. 5	2. 2
Bone Meal (T.P. 45 per cent.) ...	9.10	9.10†	9. 0	9. 0	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	8. 5†	8. 0	7. 5	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12 15	...	12. 5	12. 5	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4 ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

NOTES ON FEEDING STUFFS FOR JANUARY.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),

Ministry of Agriculture and Fisheries.

Mineral Mixtures for Stock.—The body of a farm animal contains from 3 to 5 per cent. of mineral substances, which are chiefly present in the bones, but are also present in lesser amounts in the flesh and the body fluids.

DESCRIPTION.	Price per Qr.		Price per Ton.	Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb. Starch.	Price per Unit.		Price per lb. Starch Equiv.
	s.	d.	£ s.	£ s.	£ s.		s.	d.	
Wheat, British	44/6	504	9 18	0 18	9 0	71.6	2/6		1.34
Barley, British Feeding	31/-	400	8 14	0 14	8 0	71	2/3		1.20
" American	32/3	400	9 1	0 14	8 7	71	2/4		1.25
" Danubian	32/-	400	8 19	0 14	8 5	71	2/4		1.25
" Persian	30/9	4.0	8 12	0 14	7 18	71	2/3		1.20
Oats, English White	32/6	336	10 17	0 16	10 1	59.5	3/5		1.83
" " Black & Grey	29/6	336	9 17	0 16	9 1	59.5	3/1		1.65
" Scotch White	36/-	336	12 0	0 16	11 4	59.5	3/9		2.01
" Irish, Black	27/-	320	9 9	0 16	8 13	59.5	2/11		1.56
" Canadian No. 2									
" " Western	33/-	320	11 11	0 16	10 15	59.5	3/7		1.92
" " No. 2 Feed	30/-	320	10 10	0 16	9 11	59.5	3/3		1.71
" American	28/3	320	9 18	0 16	9 2	59.5	3/1		1.65
" Argentine	29/6	320	10 6	0 16	9 10	59.5	3/2		1.70
" Chilian	31/3	320	10 19†	0 16	10 3	59.5	3/5		1.83
Maize, Argentine	38/-	480	8 17	0 15	8 2	81	2/-		1.07
" American	38/-	480	8 17	0 15	8 2	81	2/-		1.07
Beans, English Winter	53/-	532	11 3	1 17	9 6	67	2/9		1.47
" Rangoon	8/6	112	8 10	1 17	6 13	67	2/-		1.07
Peas, English, Dun	62/-	504	13 16	1 13	12 3	69	3/6		1.87
" " Maple	90/-	504	20 0	1 13	18 7	69	5/4		2.86
Peas, Home-grown	33/-	504	7 7	0 18	6 9	71.6	1/10		0.98
Millers' offals—									
Bran, British	—	—	7 5	1 12	5 13	45	2/6		1.31
Broad Bran	—	—	8 0	1 12	6 8	45	2/10		1.52
Fine middlings (Im-ported)	—	—	9 12	1 6	8 6	72	2/4		1.25
Coarse middlings (British)	—	—	8 2	1 6	6 16	64	2/2		1.16
Pollards (Imported)	—	—	7 2	1 12	5 19	60	1/10		0.98
Barley Meal	—	—	10 15	0 14	10 1	71	2/10		1.52
Maize	—	—	10 10	0 15	9 15	81	2/5		1.29
" Germ Meal	—	—	10 10	1 2	9 8	85.3	2/2		1.16
" Gluten-feed	—	—	9 10	1 12	7 18	75.6	2/1		1.12
Locust Bean Meal	—	—	8 0	0 11	7 9	71.4	2/1		1.12
Bean Meal	—	—	13 0	1 17	11 3	67	3/4		1.78
Fish	—	—	14 10	5 1	9 9	53	3/7		1.92
Linseed	—	—	29 10	1 16	18 14	119	3/1		1.65
" Cake, English (9% oil)	—	—	13 17	2 5	11 12	74	3/2		1.70
Soya Bean Cake (6% oil)	—	—	12 5	3 3	9 2	69.1	2/8		1.43
Cottonseed " English (5% oil)	—	—	7 12	2 1	5 11	42	2/8		1.43
" " Egyptian (5% oil)	—	—	7 10	2 1	5 9	42	2/7		1.38
Coconut Cake (6% oil)	—	—	9 0	1 16	7 4	73	2/-		1.07
Ground-nut Cake (7% ")	—	—	10 10	2 2	8 8	56.8	2/11		1.56
Decorticated Ground-nut Cake (9% oil)	—	—	13 0	3 4	9 16	73	2/8		1.43
Palm Kernel Cake (6% oil)	—	—	7 0†	1 7	5 13	75	1/6		0.80
" " Meal (2% ")	—	—	7 0	1 8	5 12	71.3	1/7		0.85
Feeding Treacle	—	—	4 10	0 10	4 0	51	1/7		1.85
Brewers' grains, dried, ale	—	—	8 0	1 8	6 12	49	2/8		1.43
" " " porter	—	—	7 10	1 8	6 2	49	2/6		1.34
" " " wet, ale	—	—	1 10	0 11	0 19	15	1/3		0.67
" " " wet, porter	—	—	1 4	0 11	0 13	15	1/10		0.45

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is therefore locally at £10 per ton. Its manurial value is £1 16s. per ton. The food value per ton is offered at £8 4s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 2.24, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market.

The chief elements present are calcium, phosphorus, potassium, sodium, magnesium, sulphur and chlorine, all, of course, present in a combined state.

Source of Mineral Substances.—The mineral substances, or ash, are derived chiefly from the food materials fed to farm animals. An ordinary mixed ration supplies all the mineral substances necessary to animals except sodium and chlorine, which are generally given in the form of rock salt (sodium chloride).

In ordinary grains and their by-products, calcium is deficient, but it is abundant in bone and meat meal and legume hays.

Phosphorus is abundant in bone and meat meal, bran and middlings, oil cakes, fish meal, beans and peas.

Stock likely to require Mineral Feeding.—It has been noted above, that an ordinary mixed ration will, as a general rule, contain all the mineral substances necessary for the maintenance of health, except in the case of sodium and chlorine, for which rock salt is generally supplied. Pigs, however, are largely fed on grains and grain by-products, and their rations are therefore likely to be deficient in calcium, which element is very necessary for the production of bone. In order to correct for this absence of calcium, either leguminous hay such as clover, lucerne and vetches, should be given, or some mineral substance such as steamed bone flour, should be added to the ration.

In addition there is a heavy demand for mineral substances in the case of all young growing stock, animals heavy in young, and dairy cows in milk. It is therefore advisable to supply these classes of stock with a suitable mineral mixture.

The usual and cheap sources of mineral substances are small coal, chalk, rock salt and steamed bone flour, and it is considered sound practice to have these substances always available in troughs in the feeding yards.

Recent experiments carried out by Professor Evvard at the Iowa Experiment Station, U.S.A., have emphasised the value of mineral mixtures for fattening pigs. Twelve groups of pigs were fed on rape pasture and received in addition supplemental feeds of maize, maize germ meal, linseed oil meal, and meat meal tankage. Different mineral mixtures were used, the check groups (20 pigs) receiving no mineral mixture. The pigs weighed 53 lb. at the beginning of the experiment and 225 lb. at the end.

Professor Evvard found that all groups receiving minerals did better than the no mineral groups. The gains were more rapid.

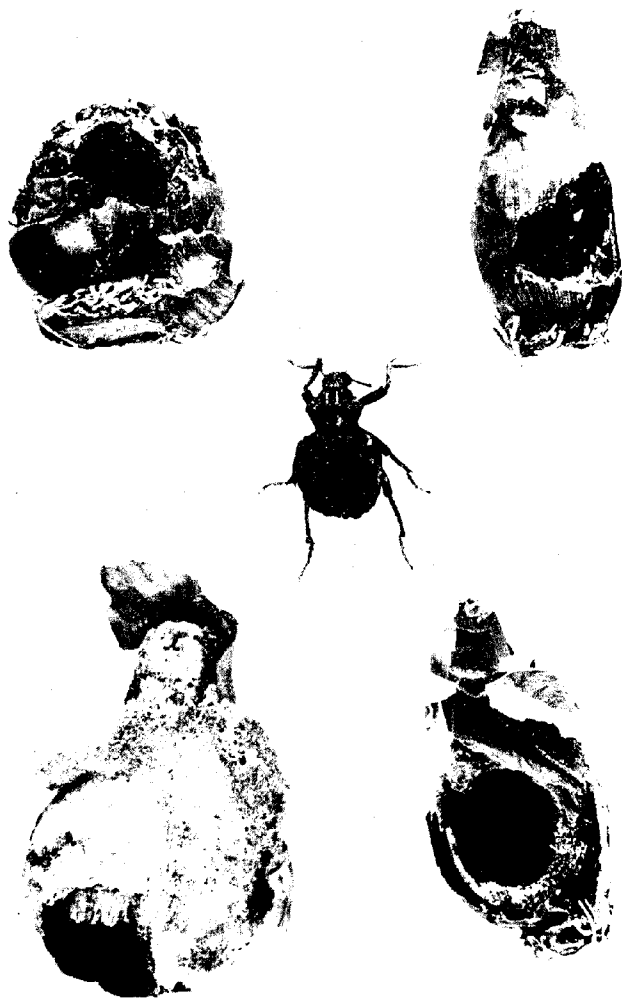


FIG. 1. Snowdrop Weevil (*Brachymerus* sp.) with damaged bulbs. (Twice natural)

the appetite better and the feed requirement per 100 lb. gain made was less. Self-feeding the minerals is the easiest method to adopt, but where hand feeding is necessary 1 lb. of minerals per month is a good allowance.

The two best mineral mixtures used in the test consisted of:—

- (1) 50 lb. highly ground limestone; 50 lb. common flake salt.
- (2) Salt, 34 lb.; spent bone black, 29 lb.; wood ashes, 14 lb.; sulphur, 11 lb.; limestone, 11 lb.; potassium iodide, 5 oz.

The check groups required 473 lb. of food for every 100 lb. gain, the groups getting mineral mixture (1) 388 lb. food for 100 lb. gain, and the group getting mineral mixture (2) 383 lb. food per 100 lb. gain.

These experiments indicate very clearly that for pigs fattening out at about 200 lb. a very material advantage will ensue from the feeding of suitable mineral mixtures.

It is obvious, of course, that the need for mineral substances will vary according to the nature of the foods fed, and the results obtained above will not necessarily hold good for a different food mixture. The results, however, are sufficiently striking to merit serious consideration by all stock feeders.

FARM VALUES.	Value per	Mineral	Food	Starch	Value	Market
	Ton on	Value per	Value per	Equivalent	per	Value per
	Farm.	Ton.	Ton.	per 100 lbs.	unit	lb. S.E.
	£ s.	£ s.	£ s.		s. d.	d.
Wheat - - - -	8 1	0 18	7 3	71.6	2/-	1.07
Oats - - - -	6 15	0 16	5 19	59.5	2/-	1.07
Barley - - - -	7 16	0 14	7 2	71	2/-	1.07
Potatoes - - - -	2 0	0 4	1 16	18	2/-	1.07
Sweeties - - - -	0 17	0 3	0 14	7	2/-	1.07
Mangolds - - - -	0 15	0 3	0 12	6	2/-	1.07
Good Meadow Hay - -	4 19	0 16	4 3	31	2/8	1.43
Good Oat Straw - -	2 13	0 8	2 5	17	2/8	1.43
Good Clover Hay - -	5 9	1 4	4 5	32	2 8	1.43
Vetch and Oat Silage -	2 2	0 9	1 13	14	2 4	1.25

A WEEVIL DESTRUCTIVE TO SNOW-DROP BULBS.

From the Pathological Laboratory.

WHEN a consignment of snowdrop bulbs imported in July of the present year from Smyrna was inspected under the Destructive Insects and Pests Order, the Inspector (Mr. Southwell) discovered that a considerable number of the bulbs were infested by larvae of an unknown weevil. The grubs were white in colour, as large as those of the Narcissus Fly, and were causing a very similar type of damage except that the destruction of the bulbs

was more complete. Specimens were received at the Pathological Laboratory and have now turned into adult beetles—stout black weevils almost half-an-inch in length which have been identified as a member of the genus *Brachycerus*. No representative of this genus is known in Great Britain and it has yet therefore no English name.

In the countries bordering the Mediterranean and also in Russia several kinds of *Brachycerus* are known, and in all cases in which their habits have been studied they have proved to be bulb feeders—three species for instance attack onion or garlic, and another *Scilla*. It is quite uncertain if the new weevil would be able to establish itself in Britain but taking into account the damage done by the Narcissus Fly, also a representative of a Mediterranean genus, it is clearly unwise to allow the insect any chance of spreading, and with the cordial co-operation of the importers, steps have been taken to ensure the destruction of all weevils in the consignment. Snowdrops themselves may not have any great economic value but the fact that species of *Brachycerus* also attack onions renders the matter of more importance, and it is satisfactory that the danger in this particular instance no longer exists. The Ministry propose to continue the inspection of imported bulbs coming from Mediterranean districts.

* * * * *

AGRICULTURAL RETURNS, 1922:

PRODUCE OF POTATO AND ROOT CROPS IN ENGLAND AND WALES.

THE following preliminary statement showing the estimated total produce and yield per acre of the potato and root crops in England and Wales in 1922, with comparisons for 1921, and the average yield per acre of the ten years 1912-1921, was issued on 28th November, 1922:—

Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per Acre.		Average of the Ten Years 1912-21.
	1922.	1921.	1922.	1921.	1922.	1921.	
Potatoes	<i>Tons.</i> 3,986,000	<i>Tons.</i> 2,958,000	<i>Acres.</i> 561,177	<i>Acres.</i> 557,800	<i>Tons.</i> 7.1	<i>Tons.</i> 5.3	<i>Tons.</i> 6.0
Turnips and Swedes.	10,890,000	6,608,000	819,961	893,176	13.3	7.4	12.3
Mangold	8,555,000	6,251,000	421,458	373,065	20.3	16.8	18.7

Potatoes.—The planting of potatoes was late on the whole, and early crops suffered from the spring drought and late frosts. Those lifted before the rains gave light yields, but there was much improvement later. Main crops kept healthy and vigorous throughout the growing period, and when lifted the tubers were large, with little disease showing. The bulk of the crop was secured in good condition during the dry weather of October. The yield per acre of potatoes is estimated at 7.1 tons, or $1\frac{3}{4}$ tons per acre more than last year, and rather more than one ton per acre above the average of the ten years 1912-21. This year's yield is the highest recorded since these returns were first collected in 1885, the previous best being 6.9 tons per acre in 1908. Crops were well above average in all parts of the country, except in some of the north-western counties, where the yields were only slightly better than usual. The total production of potatoes on agricultural holdings in England and Wales is estimated at 3,986,000 tons, or more than one million tons greater than in 1921, and 50 per cent. above the pre-war average.

Turnips and Swedes.—In the west of the country there was much difficulty in obtaining a plant of swedes, as fly was very troublesome; but attacks of fly were not severe in the east. Turnip sowing was delayed in many districts as the soil was too dry until the end of June, but good plants were then obtained, as a rule. Crops, however, remained backward throughout the summer in the west of the country, and the roots are small; but in the east and south both turnips and swedes did well. The total production of turnips and swedes, 10,890,000 tons, is some $4\frac{1}{4}$ million tons greater than the very poor production of last year, but is more than one million tons below the average of the ten years 1912-21, as a result of the reduction in area. The yield per acre is estimated at 13.8 tons, or one ton above average, and practically six tons heavier than in 1921. The eastern counties yielded on the average 3 tons per acre more than usual, but the north-western counties were deficient by a similar amount. In Wales the yields were $2\frac{1}{2}$ tons per acre below average.

Mangolds.—Mangolds also did much better in the east than elsewhere; in the north and west the roots are on the small side as a result of lack of sun, but crops were generally harvested under favourable conditions. On the whole this crop yielded well, giving 20.3 tons per acre, or $1\frac{1}{2}$ tons more than the 10-year mean, and $3\frac{1}{2}$ tons more than last year. Crops were

very heavy in the eastern and south-eastern counties, where yields were more than 5 tons and 3 tons per acre respectively above average. In the west midlands and south-west crops were variable, but about average on the whole; whilst in the north and in Wales yields were about $1\frac{1}{2}$ to 2 tons per acre below average. The total production, 8,555,000 tons, is $2\frac{1}{4}$ million tons greater than last year, and nearly one million tons above the 10-years' average.

The very satisfactory crops of roots are welcome in view of the light hay crop, and it is expected that in most districts the supply of winter keep for live stock, though not plentiful, will be sufficient.

* * * * *

By arrangement with the authorities of University College, Reading, a special course of instruction in milk recording was held in the spring of 1922, intended mainly for students who desired to obtain employment as milk recorders under the Ministry's Milk Recording Scheme. Twenty-four students took the course and 17 passed the examination held at its close. Four of the successful students were already employed as recorders of Milk Recording Societies, and twelve others were desirous of taking up such appointments, chiefly with a view to gaining experience.

Arrangements have been made to hold a similar course of instruction at University College, Reading, from 27th February to 16th March, 1923, provided that a sufficient number of students apply for admission, the number of entries being limited to 24. A syllabus showing full particulars of the course may be obtained on application to the Faculty of Agriculture, University College, Reading. The course includes lectures on milk, its nature and composition, on bacteria and their relation to milk, testing of milk, and the principles and practice of milk recording; and practical work on actual milk recording of a comprehensive character, including food records, cost of foods, and cost of food per gallon of milk. The tuition fee will be £3 3s. Board and residence is obtainable in the neighbourhood at rates varying from £1 15s. to £2 5s. a week, and a list of such lodgings is obtainable from the College.

Preference will be given to students who are either already milk recorders under the Ministry's scheme or who intend to apply for such posts. It is not possible to give any indication as to what vacancies for milk recorders may arise, nor can any

guarantee be given that students will in fact obtain employment as milk recorders. The names of successful students will, however, be circulated by the Ministry to all Milk Recording societies in order that preference may be given by societies to these students on the occasion of filling a vacancy. The appointments carry salaries, ranging usually from £150 to £250 per annum, and they afford to young agriculturists a unique opportunity of acquiring a practical knowledge of dairy farming, often of the best type, as carried out on a variety of farms.

* * * * *

THE Ministry has been informed by the authorities of University College, Reading, that arrangements have been made for a short course of instruction in the production and handling of milk, to be held at the College from 31st January to 24th February, 1923. Particulars of the course, which will be conducted on the same lines as the courses in Clean Milk Production held in February last and in 1921, are shown in the syllabus outlined below :—

Syllabus of the Course.—The instruction will consist of lectures, laboratory work, demonstrations, and visits to well-known dairy establishments. The course is intended primarily for instructors in dairying, but other applicants will be admitted so far as accommodation allows. It is essential, however, that all applicants for admission shall have had some systematic training in dairying and the sciences related thereto.

The tuition fee for the course is £5, which does not include the necessary travelling expenses in connection with the excursions. As the course will be held during term it will be impossible to offer accommodation in a Hall of Residence, but the College will supply a list of addresses where suitable rooms can probably be found.

Students should travel to Reading before 31st January, in order to be able to commence the course promptly.

* * * * *

REPLIES TO CORRESPONDENTS.

Sugar Beet.—A.B. asks for the name and address of firms who manufacture sugar from sugar-beet.

Reply: The only factory now engaged in manufacturing sugar from sugar-beet in this country is that at Cantley, Norfolk.

Basic Slag.—C.D. proposes to give a paddock on which pigs and poultry are run a dressing of basic slag, and asks whether either will take any harm from this.

Reply : Though no evidence is available that poultry suffer any ill-effects from being put on to newly slagged pasture, it would be advisable both with poultry and with other livestock to wait, as recommended in Leaflet No. 267, until a heavy shower has washed most of the slag off the herbage.

Manurial Value of Goose Droppings.—E.F. has found that geese keep a lawn cropped very closely and that a luxuriant crop springs up afterwards. He asks whether cattle would eat grass after geese had been on it, and whether geese would do good on a meadow kept for hay.

Reply : A copy of Leaflet No. 198, which refers to grazing geese, was sent to the correspondent, who was informed that as regards the alleged destruction of herbage, this will generally be avoided when only a limited number of geese are allowed to graze on a given spot, especially if by means of hurdles or otherwise they can be moved from one part to another of the ground. In that case they are likely to be more beneficial than otherwise. Reference was also made to the article in this *Journal* for March, 1907, on Poultry Manure.

Meadow Saffron.—G.H. asked whether it is true that the autumn flowers do not poison while the spring flowers do.

Reply. A copy of Leaflet No. 222 was sent and correspondent informed that Meadow Saffron (*Colchicum autumnale*, L.) does not flower in the spring, but in the autumn. Possibly confusion has arisen owing to the fact that there are non-poisonous species of crocus which are called saffron (e.g. *Crocus aureus*, Sibth.—spring flowering, and *Crocus sativus*, L.—autumn flowering.)

Fallows and Bastard Fallows.—J.K. writing from Cumberland asks for information as to fallows and bastard fallows.

Reply : Leaflet No. 172, which deals with bare fallows, was sent and the following information added:—"For fallowing spells of dry weather are essential and it is consequently better adapted to the south than the north. To be successful fallows must be worked at the right time and the 'right time' generally clashes with hay-time or harvest or other busy season."

Stoats in a Poultry Yard.—L.M. suspects stoats of depredations in a poultry yard.

Reply : "Stoats, martins, &c., may be killed with strychnine-poisoned eggs. The following directions should be observed:—

Carefully remove with a very sharp knife a small piece of the shell, insert 1 grain of strychnine, replace the removed fragment of shell using a little of the egg albumen for the purpose. The operation should be carried out skilfully to allay the stoat's suspicion.

Before using the poisoned eggs try to get the stoat's appetite attracted by placing unpoisoned eggs for a few nights at his disposal. When he takes these, miss a night and let him have the prepared ones.

Ordinary poisons are of no use as the stoat kills for the lust of blood, simply sucking the bodies of its victims dry.

In using strychnine-poisoned eggs the greatest care in the preparation and application of same is essential. The chickens should be kept, if only temporarily, in stoat-proof pens."

Manurial Value of Feeding Stuffs.—N.O. asks how to calculate the manurial value of feeding stuffs.

Reply : "A rough method of calculating the manurial value of feeding stuffs is given on page 11 (1922 edition) of the Ministry's *Miscellaneous Publication No. 32 on Rations for Live Stock*.

Where the content in nitrogen (N), phosphoric acid (P_2O_5) and potash (K_2O) of any given feeding stuff is known the method adopted by Hall and Voelcker (see *Journal of the Royal Agricultural Society*, Vol. 74, 1913, p. 104) is usually employed. By this method in calculating manurial value, allowance is made for half the nitrogen and three-quarters each of the phosphoric acid and potash.

The unit values assigned for these three constituents vary with the prices of artificial manures. They are given week by week in the "Agricultural Market Report" published by the Ministry,* except for insoluble phosphates. The method of working out the unit value of insoluble phosphate is explained in the Ministry's Leaflet No. 72, which also gives the rules for converting phosphate into phosphoric acid."

* * * * *

Allotments Advisory Committee.—In accordance with the recommendation of the Departmental Committee on Allotments, the Minister of Agriculture and Fisheries has appointed a Committee to advise the Ministry on matters affecting allotments in England and Wales. The constitution of the Committee is as follows:—

The Rt. Hon. the Earl of Ancaster, Parliamentary Secretary to the Ministry.
(Chairman).

The Rt. Hon. the Earl Stanhope, representing the Central Landowners Association.

Sir Kingsley Wood, M.P., representing the Parliamentary Allotments Committee.

Francis Dent, Esq., representing the County Councils' Association.

H. A. Learoyd, Esq., Town Clerk of Hull, representing the Association of Municipal Corporations.

Reginald C. Graves, Esq., LL.B., Clerk and Solicitor to the Tottenham Urban District Council, representing the Urban District Councils' Association.

C. Crofton Black, Esq., Barrister-at-Law, representing the Land Union.

The Rt. Hon. F. D. Acland,	} representing the Agricultural
George Nicholls, Esq., O.B.E.,	
Walter West, Esq.,	} Organization Society.

Robert Norman, Esq.,	} representing the National Union
Alderman H. Berry,	
J. Forbes, Esq.,	
	} of Allotment Holders.

The Secretary of the Committee is Mr. E. Lawrence Mitchell, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1.

The London Thoroughbred Stallion Show for 1923.—The Ministry (acting on behalf of the War Office) gives notice that a Show of Thoroughbred Stallions will be held, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, at the Royal Agricultural Hall, Islington, on 27th and 28th February and 1st March, 1923.

A Challenge Cup, presented by H.M. the King, will be awarded for the Champion Stallion in the Show; and a Gold Medal will be awarded by the Ministry to the owner. Sixty King's Premiums (including 12 Super-Premiums) will also be offered for award by the Ministry.

In addition to the King's Premiums, a very limited number of Ministry's Premiums will be available for award on the recommendation of the County

* Also monthly in this *Journal*.

Horse Breeding Committees. These awards will not be made, however, until the routes of the King's Premium stallions have been arranged.

Copies of the Regulations governing the award of the Premiums can be had on application to the Ministry after 11th December.

Export of Dogs to the Channel Islands.—The Ministry is advised that the restrictions as to the importation of dogs into the Channel Islands from Great Britain referred to in the August issue of the *Journal* have now been withdrawn. Accordingly, no certificate issued by the Ministry or other document is necessary in this connection.

The regulations concerning dogs imported into the Islands from countries abroad, as stated in the August issue of the *Journal*, are still in force.

West Surrey Goat Club.—The following note has been received from Mrs. Epps of the West Surrey Goat Club:—The West Surrey Goat Club is one of the many county goat clubs that have arisen since the war. It was founded in 1919 by a small Committee which had organised the first Guildford goat show, and from the time of its inception to the present date it has steadily extended the scope of its activities. The management of the Club is vested in a Committee of twelve members; the membership is about 200, more than half of these being of the cottage class. The difficulty of dealing by correspondence with cottage stock-keepers is well known, and the Club has found that a system of local supervisors is readily workable. Membership is quite open, and the subscription for ordinary members is 6s. and for cottage members 1s. 6d. The funds are devoted to promoting village shows, issuing a quarterly leaflet to members and placing good billies at stud at moderate fees.

The Club has recently purchased a fine Toggenburg male imported by the British Goat Society, and this animal is now available for service, Club members getting very advantageous terms.

A large open show is held at Guildford annually, but the Club finds its best recruiting ground at the village shows, for here the cottagers are glad to bring their goats to compete against their neighbours without the trouble and heavy expense of a rail or road journey and the loss of the day's milk.

The Club offers every encouragement to the many people who find difficulty in getting an adequate supply of cows' milk but are able to maintain one or two goats. This class of goat-keeper is not in a position to maintain a good stud goat, and the Club endeavours to provide good billies throughout the county to supplant the third-rate animals that are too frequently used.

Another matter of importance that the Committee is interested in is that of the milk yields of the ordinary goat. At present the only figures available deal with exceptional exhibition animals, but if figures could be obtained as to the yield over a lactation period of the usual type of goat kept in the county, the information would be of considerable value. A few herds are recorded under the milk recording schemes devised for dairy herds, but the cost of this is prohibitive to the small goat-keeper.

Foot-and-Mouth Disease.—No further outbreaks having occurred in the Woodstock (Oxon) or Surrey districts, all restrictions on the movement of animals in these districts were removed on 4th and 15th December respectively.

On 29th November, an outbreak of foot-and-mouth disease was confirmed on premises at Huntingdon, near Chester, which necessitated the application of restrictions to the usual area of 15 miles radius from the infected place.

Further outbreaks occurred on 1st December at Handley (5 miles distant), on 6th December at Whitby, near Birkenhead, and on 12th December at Tattenhall, in the vicinity of the original outbreak. The restrictions in the outer portion of the prohibited area have been modified, but the size of the area had not been reduced up to 18th December, the date to which the information contained in this note is carried.

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QUESTIONS IN PARLIAMENT.

Telephones in Rural Areas.—In reply to a question in the House of Commons by Mr. Millar on 30th November as to the terms on which new telephone exchanges are now being opened in rural areas and the present tariff and rates for rural party lines, the Postmaster-General, Mr. Neville Chamberlain, said: "New exchanges are being provided in rural areas at an installation rental of £2 a quarter per circuit, within a mile of the exchange, provided that at least eight subscribers are forthcoming and the cost of the line required to connect the new exchange with the existing system is not abnormally high. If 15 subscribers can be found the normal tariff charges apply. These terms cover a day service only, but it is often possible by a party line arrangement to extend the subscribers' circuits at night to an exchange open always, subject to a payment of 5s. a quarter. Two-party lines are offered at lower rates than the exclusive service charges to those who live more than a mile from an exchange. Rural party lines are provided at a charge of £1 or £1 2s. 6d. a quarter per station where three or two subscribers respectively per mile of line beyond a radius of half a mile from the exchange can be found. Rural party line rentals cover an unlimited number of calls to subscribers on the same exchange."

Importation of Irish Store Cattle.—The following summary of the conditions on which Irish store cattle may now be imported was given by the Minister for Agriculture in the House of Commons on 5th December in answer to a question by Lt.-Col. Murray:—"Store cattle brought from Ireland to Great Britain are required to be landed only at approved landing places, where each cargo has to be detained for at least 10 hours for rest and examination by veterinary inspectors of the Ministry. All cattle must be marked before landing. No cattle may be removed from the landing place except with a licence of the Ministry's inspector, and then only to

- (a) A market or part of a market authorised by the local authority for the sale of Irish animals, from which they can only be moved by licence of the local authority's inspector to private premises for six days' detention; or
- (b) private premises, i.e., any premises other than a market, fair-ground or sale yard, where the cattle must be detained for six days.

Provision is made for the slaughter of any of the animals during the period of detention, if required. To facilitate marketing, the cattle may *en route* from the landing place to the market, be temporarily kept in authorised lairs or enclosures under the control of the local authority for a period not exceeding 72 hours whilst awaiting exposure for sale.

NOTICES OF BOOKS.

The Agricultural Note Book.—(Primrose McConnell, B.Sc. Tenth Edition. London: Crosby, Lockwood & Son, 1922. 15s. net.) The first edition of this work was published in 1883 and the ninth edition in 1919. It is so well known as a work of reference, that probably few who are engaged in agriculture are unfamiliar with it. It deserves as a motto a Latin distich prefixed to a sixteenth century volume, itself not wholly unconnected with agriculture, to the effect that the writer who gets much within the limits of a compact volume deserves as much credit as the speaker who adequately deals with a wide subject in few words. The latest edition is in form as concise and handy as the earlier. But numerous alterations are apparent. The costs of labour have been revised and compensation values of feeding stuffs have been re-adjusted. The figures assigned, however, are in the light of present times, distinctly on the high side and will need correcting periodically. Current manurial values for most feeding stuffs will, it may be noted, be found in the Monthly Notes published in this *Journal*. A new paragraph on vitamins brings information on this question up to date. Practically every third or fourth page shows traces of revision. While everybody who has to deal with farming should already possess this book, those who have been remiss are penalised slightly by the unavoidably enhanced post-war price, while they reap the unmerited reward of being provided with an edition even more useful than its very useful predecessors.

The Feeding of Dairy Cattle.—(Andrew C. McCandlish, M.S.A., Professor of Dairy Husbandry, Iowa State College, U.S.A. 8vo., 281 pp., 15 illustrations. London: Chapman & Hall, Ltd., 1922. Price 12/6 net.) This handy little volume deals in simple, non-technical language with the importance of the Dairy Cow as an economic factor in husbandry. First of all the main principles of nutrition are briefly reviewed after which the problems of practical feeding are discussed.

The Dairy Cow is looked upon as the market for home-grown foodstuffs in respect of which the Dairy Farm should be self supporting. The Author points out that as a rule, only concentrates of high protein contents need be purchased and indicates the chief considerations which should govern their choice. A useful table is included showing how to arrive at the relative cost of digestible crude protein in the commoner feeding stuffs.

Short chapters are devoted to Calf-rearing and to digestive disturbances among stock.

Analyses and Energy Values of Foods.—(R. H. A. Plimmer, D.Sc. London: H. M. Stationery Office, Imperial House, Kingsway, W.C.2.) This book is a useful compendium of analyses and energy values of foods in common use in this country, and should prove of value to all interested in dietetics.

The aim of the author has been to arrive at an average for each group of foodstuffs, such as beef from analyses of the various joints, bread from the produce of various bakeries, fish from the group of white fish, etc. In the case of meat the joints were separated into fat, skin, lean, and so forth, and the proportions determined so as to calculate the whole. Further, the

proportions of the joints of the carcass have been ascertained so that the composition of any part and ultimately of the whole animal can be arrived at.

The analyses number about 900, and the data recorded include most of the common foods such as meat, poultry and game, cheese, bacon, ham and pork, tinned meats, eggs fresh and dried, fish, fruit, nuts and vegetables. The book contains the analytical data necessary for the construction of dietaries for human use, and is worthy of study by all whose duties include the supervision and designing of dietaries for use in schools and other institutions.

Cyclopedia of Farm Animals and Cyclopedia of Farm Crops.—(L. H. Bailey. London: Macmillan & Company Ltd. Price 25/- nett each.) These two volumes, each containing about 700 pages of well printed and well illustrated matter, are re-issued from the *Cyclopedia of American Agriculture*, which is now out of print. The arrangement of both volumes follows the Caesarean division into three parts, the first part dealing generally with physiology, breeding, diseases and management, the second with the manufacture of products—(i) dairy and meat products, and (ii) fruit and vegetable preserving, brewing, etc.—while the third part deals in alphabetical sequence with farm animals and crops respectively. Although written from the American standpoint, these volumes should prove a most useful and comprehensive work of reference for farmers and students in other countries.

Sturtevant's Notes on Edible Plants.—(U. P. Hedrick. Albany, U.S.A.: J. B. Lyon Company.) This interesting and valuable compilation issued under the editorship of Dr. U. P. Hedrick, Horticulturist to the New York Agricultural Experiment Station, is based on material collected by the late Dr. E. Lewis Sturtevant, who was Director of the Station from 1882 to 1887. Geographical and historical details are given of the distribution, variations and uses of nearly 3,000 edible plants, arranged in alphabetical order according to genera (following the nomenclature of the Kew Index), species being given alphabetically under each genus, followed by English vernacular names as used in the standard botanical text-books. The volume, which represents the results of long and extended research in botanical literature, is enriched by a copious bibliography and index and is handsomely printed and bound.

Les Insectes et leurs Degats.—(E. Douge et P. Estiot (*Encyclopédie Pratique du Naturaliste*.) Paris: Paul Lechevalier. Price 15 francs.) This is a pocket size book of 244 pages, the first half of which is devoted to a general exposition of the organisation, development, classification and habits of insects, followed by a chapter containing directions for the preparation and application of insecticides. The second half consists of detailed notices with coloured plates, of the insects most frequently attacking culinary plants, fruit and forest trees, field crops, flowers and ornamental plants.

Les Champignons comestibles et vénéneux.—(A. Maublanc (*Encyclopédie Pratique du Naturaliste*.) Paris: Paul Lechevalier. Price 15 francs.) A companion volume to the entomological work noted above, the first half dealing generally with fungi and their classification, the second consisting of coloured plates, with explanatory notes, illustrating the most important edible and poisonous mushrooms and toadstools.

La Destruction des Mauvaises Herbes.—(E. Rebaté. Paris: Librairie Agricole de la Maison Rustique. Price 4.50 francs.) Any information which will aid us to combat weeds will always be useful, and the little

book by Rabaté is intended to be so. It opens with a brief discussion as to the damage done by weeds, their classification, increase, and accumulation of their seeds in the soil. It next proceeds to discuss preventive and remedial measures such as may be used by farmers, and briefly touches on French administrative measures designed to reduce weeds. Destruction of weeds by chemical means is dealt with at some length (82 pages) the substances covered being mineral acids, caustic soda, caustic potash, sulphate of zinc, sulphate of ammonia, nitrate of soda, sea salt, calcium chloride, kainit, arsenite of soda, cyanamide, crude ammonia, calcium sulphide, various organic and other chemical substances, sulphates of iron and copper, nitrate of copper, bisulphate of soda, and sulphuric acid. The last 43 pages are devoted to a consideration of various weeds of cornfields, and of grass land.

Diseases of the Small Domestic Animals.—(O. V. Brumley, V.S. London: Baillière, Tindall and Cox. Price 21/- nett.) This volume is a classified dictionary of most of the important diseases (medical and surgical) of small animals with which the veterinarian comes into contact. Under the headings "Diseases of the Respiratory System . . . Circulatory System . . . Digestive Tract . . . Skin, Ear, Eye, etc.," information is given as to causes, symptoms and treatment. The four chapters comprising the last section deal with infectious diseases, including fowl cholera, fowl pest, anthrax, foot-and-mouth disease, rabies and glanders. The work should be useful to the student and the busy practitioner for whom it is primarily intended.

Principles and Practice of Butter-Making.—(By G. L. McKay, D.Sc., Secretary American Association of Creamery Butter Manufacturers, formerly Professor of Dairying in the Iowa State College, Ames, Ia., and C. Larsen, M.S.A., Professor of Dairy Husbandry, So. Dak State College, Brookings S.D., formerly Associate Professor Iowa College, Ames, Ia. Third edition largely rewritten. London: Chapman & Hall, Ltd. Price 15/- net.)

The third edition of this valuable publication shows evidence of a very careful revision. In addition to a very complete account of the technical process of butter on the most approved lines, it contains a considerable amount of other useful information on such subjects as the properties of milk, the food value of milk, ferments in milk, abnormal milk, variation in the fat of milk, the sampling, grading and testing of milk, composite samples, creamery calculations, separation of cream, pasteurisation, refrigeration, creamery economics, etc. It can be recommended as a safe guide to Dairy Factory Managers, and is a book which all dairy students would do well to consult.

From Crow-Scaring to Westminster: An Autobiography.—(George Edwards, M.P., O.B.E. 240 pp., 5 illustrations. London: The Labour Publishing Co., Ltd., price 5/-.) Born in a family on the verge of starvation, himself starting farm work at the age of 6, unable to read until taught by his devoted wife in brief evenings after arduous daily toil and eventually rising to represent his native county in Parliament. Mr. George Edwards is indeed, as Lord Ailwyn says in a foreword to his Autobiography, a notable example of the way in which adverse circumstances may be overcome by determination and natural ability. Devoted as his life has been to the betterment of the lot of his fellow agricultural workers, his story is largely that of the conception and development of a spirit of class consciousness and organisation among them. Not only, however, does the author give a frank account of the struggles and disappointments of his organising activities but his pages afford many a valuable glimpse into the actual conditions of living amongst agricultural workers in the early Victorian era. This famous pioneer of the agricultural workers' cause, who is now the honoured veteran respected by all parties, concludes on a note which will appeal to all concerned in the present difficult times: "let the spirit of moderation and goodwill dwell amongst you."

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

- Raw, Sir R. Henry.*—The Story of the Agricultural Club, 1918—1921. (205 pp.) London: P. S. King & Son, Ltd., 1922, 10s. 6d. net. [331(b); 338.1(02); 63(062).]
- Development Commission.*—Industries in Rural Districts, by E. C. Kny. (25 pp.) 1921. [63.193.]
- McConnell, Primrose.*—Notebook of Agricultural Facts and Figures for Farmers and Farm Students. [Tenth Edn., rev. and cal.] (549 pp.) London: Crosby, Lockwood & Son, 1922, 15s. net. [63(03).]
- The Faraday Society.*—Physico-Chemical Problems Relating to the Soil: A General Discussion held at the Society. [Reprint from the Transactions of the Society, vol. xvii, pp. 218-368.] London, 1922, 10s. 6d. [63.112; 63.113.]
- West of Scotland Agricultural College.*—Bull. 101:—Rotation Cropping on a Demonstration Area in Wigtownshire. (24 pp.) Glasgow, 1922. [63.191.]
- Canada Department of Agriculture.*—Bull. 8 (New Series):—Fertilisers for Field Crops: their Nature, Functions and Application, with Results from recent Experiments in Canada. (64 pp.) Ottawa, 1922. [63.16(04).]
- Fourmier, L.*—Les Stimulants Radio-Actifs en Agriculture: leur Rôle dans les Engrais. (73 pp.) Paris: Librairie de l'Institut National Agronomique, 1922, 3fr. 75. [537; 63.168.]
- Cornell Agricultural Experiment Station.*—Bull. 406:—Decomposition of Green Manures at Different Stages of Growth. (pp. 139-169.) Ithaca, 1921. [63.165.]
- Scott, A., and M'Arthur, D. N.*—The Constitution of Basic Slag. (Reprinted from the Journal of the West of Scotland Iron and Steel Institute, session 1921-22. pp. 80-102.) Glasgow, 1922. [63.1672.]
- Carola, C. V.*—Engrais: I. Les Matières Fertilisantes. (348 pp.) Paris: J. B. Baillière et Fils, 1921, 10fr. [63.16(02).]
- Carola, C. V.*—Engrais: II. La Pratique de la Fumure (356 pp.). Paris: J. B. Baillière et Fils, 1921, 10fr. [63.1625.]
- [These two volumes form an up-to-date revision of the text book by this eminent French authority. The extended form allows of greater detail being devoted to the technique of manuring, and a review of the regulations governing the sale of manures in France is included.]
- Institut International d'Agriculture.*—Ramassage et Utilisation des Déchets et Résidus pour l'Alimentation de l'Homme et des Animaux, pour les Engrais et les Industries Agricoles (1914—20). (336 pp.) Rome, 1922, 20fr. [58.16; 63.16(02); 63.163; 63.165; 63.604(a).]
- Rabaté, E.*—La Destruction des Mauvaises Herbes. (164 pp.) Paris: Librairie Agricole de la Maison Rustique, 1922, 4fr. 50. [63.259(02).]
- Maublanc, A.*—Les Champignons comestibles et vénéreux de France. (110 pp. et 86 planches coloriées.) Encyclopédie Pratique du Naturaliste. vol. viii. Paris: P. Lechevalier, 1921, 15fr. [63.24(02).]
- Grey, Edwin.*—Rothamsted Experimental Station: Reminiscences, Tales and Anecdotes of the Laboratories, Staff and Experimental Fields, 1872-1922. (155 pp.) Harpenden: Rothamsted Experimental Station, 1922, 5s. [37(072).]
- [Many to whom the scientific achievements of the Rothamsted Experimental Station are well known will find a lightsome human charm in the personal record of Mr. Grey, the genial "Field Superintendent," whose association with the Station, dating from 1872 when as a boy he went to work as a grass picker on the experimental plots, has brought him into intimate contact with all ranks of his fellow-workers, from the famous founders, Lawes and Gilbert, to the present Director, Sir John Russell, who contributes an introduction to the book.]
- National Institute of Agricultural Botany.*—4th Annual Report of the Official Seed Testing Station, August, 1920 to July, 1921 (14 pp.) Cambridge, 1922, 1s. 6d. [63.1951.]

- Buchanan, R. E.*—Agricultural and Industrial Bacteriology. (468 pp.) New York and London: D. Appleton & Co., 1921, 15s. net. [576.8(02).]
[A general survey of bacteriological topics of interest to farmers and others employed in trades allied to farming and farm produce.]
- Rasor, S. E.*—Mathematics for Students of Agriculture. (290 pp.) New York: The Macmillan Co., 1921, 16s. net. [51(02).]
- Peat's.*—Farmer's Diary and Account Book: A Complete and Easy Method of Keeping Farm Accounts. (104 pp.) London: Simpkin, Marshall, Hamilton, Kent & Co., 1922, 3s. [657.]
- Kirkwood, John.*—Farm Book-Keeping. The Principles and Practice of Book-Keeping applied to Agriculture for Agricultural Colleges, Extension Classes, Evening Classes and Practical Farmers. (224 pp.) Edinburgh: W. Green & Son, Ltd., 1922, 6s. net. [657(02).]
[One of the Scottish Series of Junior Agricultural Text Books prepared under the competent editorship of Professor Hendrick, of Aberdeen University. Like the other books of this series, it is written with a special view to the agricultural conditions of Scotland and the north of England, though at the same time it is justifiably hoped that it may occasionally be found useful and acceptable south of the border. The greater part of the book is devoted to a study of a Double Entry System, but a simple form of cash-book is added for the benefit of farmers who have not the time or opportunity to adopt the fuller method. Exercises are given in the different sections and an appendix gives the papers set in National Diploma examinations of 1921 and 1922.]

Field Crops.

- University of Leeds and Yorkshire Council for Agricultural Education.*—No. 123.—Report on Experiments with Wheat at Manor Farm, Garforth, and in the North Riding, 1921 (19 pp.). Leeds, 1922. [63.311(04).]
- University College of Wales, Aberystwyth, Welsh Plant Breeding Station.*—Series C, No. 2:—Varieties of Oats in Cultivation. (44 pp. and Plates.) Aberystwyth, 1922, 5s. 6d. [63.314(04).]
- U.S. Department of Agriculture.*—Bull. 1058:—Sterility of Oats. (8 pp.) Washington, 1922. [63.21.]
- Australia. Institute of Science and Industry.*—Bull. 22:—A Classification and Detailed Description of the Barleys of Australia. Being the 2nd Report of the Special Committee on Seed Improvement. (83 pp.) Melbourne, 1922. [63.313(04).]
- Midland Agricultural and Dairy College.*—Trials with Cereal Crops at the College (Lodge) Farm, 1919—21:—(a) Nitrogenous Top Dressings for Wheat. (b) Ammonium Chloride v. Ammonium Sulphate for Oats. (c) Rates for Seeding Wheat. (8 pp.) Kingston, 1922. [63.31(04).]
- Olympia Agricultural Co., Ltd., Research Department.*—Bull. 2:—Field Tests with Cereals. Seasons 1920—21. (16 pp.) Offchurch Bury, 1922. [63.31(04).]
- Olympia Agricultural Co., Ltd., Research Department.*—Bull. 1:—Field Experiments with Potatoes, 1920 and 1921. (18 pp.) Offchurch Bury, 1922. [63.512(04).]
- Midland Agricultural and Dairy College.*—Varieties and Manuring of Potatoes: Results of Trials on the College Farm, 1920—21. (14 pp.) Kingston, 1922. [63.512-16.]
- University College of North Wales, Bangor, Department of Agriculture.*—Formation of Permanent Pastures. Relation between the Seeds Mixture and the Herbage on the 6 or 7 year old Pastures. (14 pp.) Bangor, 1922. [63.33(a).]
- University College of Wales, Aberystwyth, Welsh Plant Breeding Station.*—Series H, No. 1, Seasons 1919—21. Preliminary Investigations with Herbage Plants. (97 pp.) Aberystwyth, 1922, 3s. 6d. [63.1952; 63.33(04).]
- University College of North Wales, Bangor, Department of Agriculture.*—Report on Experiments on Growth of Green Crops on Arable Land for Dairy Cows, 1920-1921. (61 pp.) Bangor, 1922. [63.33(04).]
- University College of North Wales, Bangor, Department of Agriculture.*—1920 and 1921 Reports on Formation of Permanent Pastures. (12 pp.) Bangor, 1922. [63.33(a).]

- Ontario Department of Agriculture.*—Bull. 287 :—Silos and Silage. (32 pp.) Toronto, 1922. [694; 63.1985.]
- Bailey, L. H.* (Edit.).—Cyclopedia of Farm Crops. (699 pp.) New York and London : Macmillan Co., 1922, 25s. net. [63.3(12).]
- The Chilean Nitrate Committee.*—Catch Crops and Forage Crops. (40 pp.) London, 1922. [63.33(04).]
- Cornell Agricultural Experiment Station.*—Memoir 46 :—A Classification of the Cultivated Varieties of Barley. (pp. 309-456.) Ithaca, 1921. [63.313.]

Horticulture and Fruit Growing.

- Fletcher, F. J.*—Orchard Fruit Tree Culture. [Market Nursery Work Series, vol. v.] (71 pp.) London : Benn Bros., Ltd., 1922, 4s. 6d. net. [63.41(02).]
- [One volume of a series of six which aim at placing in the hands of practical nurserymen concise and up-to-date information concerning the scientific development of their work. The present volume deals fully with the planting, budding, grafting and pruning of orchard fruit trees, together with a chapter on the marketing of produce.]
- Departmental Committee on Allotments.*—Report of the Departmental Committee appointed by the Minister of Agriculture and Fisheries and the Secretary for Scotland to investigate the present position as regards the Provision by Local Authorities of Allotments in Great Britain. (32 pp.) London : H.M. Stationery Office, 1922, 6d. net. [63.5(08).]
- Davidson, H. C.*—Vegetable Culture : A Practical Manual. (144 pp.) London : Crosby, Lockwood & Son, 1922, 4s. 6d. net. [63.511(02).]
- [A useful manual containing cultural directions for the ordinary garden-grown vegetables, which are dealt with in alphabetical order. Notes on pests and diseases are added under each crop dealt with, and a calendar indicating the dates for the various operations is given at the end.]
- Davidson, H. C.*—The Culture of Pot-Plants in Rooms, Greenhouses, and Frames. (153 pp.) London : Crosby, Lockwood & Son, 1922, 5s. net. [63.52.]
- [A companion book to the author's manual on Vegetable Culture noticed above. Following two chapters of general directions for the management of plants in rooms, greenhouses and frames, the arrangement is in groups of plants according to the purposes for which they are grown, e.g., "Winter flowering plants," "Plants grown for their scent," &c. An index is added.]
- Cruess, W. V., and Christie, A. W.*—Laboratory Manual of Fruit and Vegetable Products. (109 pp.) New York and London : McGraw-Hill Book Co., Inc., 1922, 7s. 6d. [664.84; 664.85.]
- [This manual, which is the outcome of a course given at the University of California during the last eleven years, is intended primarily for use in agricultural colleges and domestic science schools, but it contains much information which should be of value to growers, manufacturers and others interested in the preservation of fruit and vegetable products by canning, drying, &c. The volume is admirably printed and bound.]

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- University College of North Wales, Bangor, Department of Agriculture.*—Experiments with Plant Diseases :
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 (12 pp.) Bangor, 1922. [63.24; 63.24-53.]
- California Agricultural Experiment Station.*—Bull. 336 :—The Preparation of Nicotine Dust as an Insecticide. (262-274 pp.) Berkeley, 1921. [63.295.]
- U.S. Department of Agriculture.*—Farmer's Bull. 1260 :—Stored-Grain Pests. (47 pp.) Washington, 1922. [63.27-31.]
- [One of the informative bulletins issued by the American Department of Agriculture dealing briefly and in popular style with a considerable number of pests affecting grain. A short account of preventive methods is also included.]

- Smith, K. M., and Gardner, J. C. M.*—Insect Pests of the Horticulturist: Their Nature and Control. Vol. i: Onion, Carrot and Celery Flies. (76 pp.) London: Benn Bros., Ltd., 1922, 7s. 6d. net. [63.27-51.]
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- [Commencing with the Asparagus Beetle and ending with the Turnip Gall Weevil, this book deals briefly with the life histories of the various pests and diseases known to be injurious to vegetable food crops, following the alphabetical order of the crop attacked and indicating the remedies under each. Recipes are given for the preparation of insecticides and fungicides, and a final chapter deals with different methods for the sterilisation of soils.]
- Dongé, E., et Estiot, P.*—Les Insectes et leurs Dégâts. (115 pp. et 100 Planches colorées.) [Encyclopédie Pratique du Naturaliste. vol. vi.] Paris: P. Lechevalier, 1921, 15fr. [63.27(02).]

Live Stock.

- Kansas Agricultural Experiment Station.*—Circular 86:—Cattle Feeding Investigations, 1919-20. (11 pp.) Manhattan, 1921. [63.625.]
- California Agricultural Experiment Station.*—Bull. 342:—Hog Feeding Experiments. (pp. 374-396.) Berkeley, 1922. [63.645.]
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- Smetham, A., and Dodd, F. R.*—The Valuation of Feeding Stuffs by means of Chemical Analysis. (Reprint from Ann. Journal Royal Lanes. Agricultural Society, 1921.) [63.604(04).]

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- McKay, G. L., and Larsen, C.*—Principles and Practice of Butter-Making. [8rd Edition, largely rewritten.] (405 pp.) New York: John Wiley; London: Chapman & Hall, 1922, 15s. net. [63.72(02).]
- Illinois Agricultural Experiment Station.*—Bull. 236:—Germ Content of Milk. III. As Influenced by Visible Dirt. (pp. 363-390.) Urbana, 1921. [576.8: 7; 614.32.]

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- Brumley, O. V.*—A Text-Book of the Diseases of the Small Domestic Animals. (672 pp.) London: Baillière, Tindall & Cox, 1922, 21s. net. [619(02).]
- British Museum (Natural History).*—Economic Series No. 13:—Mites Injurious to Domestic Animals, with an Appendix on the Acarine Disease of Hive Bees, by *S. Hirst*. (107 pp.) London: British Museum, 1922, 3s. [63.81: 09; 59.169.]

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- Pearce, E. K.*—Typical Flies: A Photographic Atlas. [2nd Series.] (38 pp.) Cambridge: University Press, 1921, 15s. net. [59.57.]
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